AN ILLUSTRATED GUIDE TO

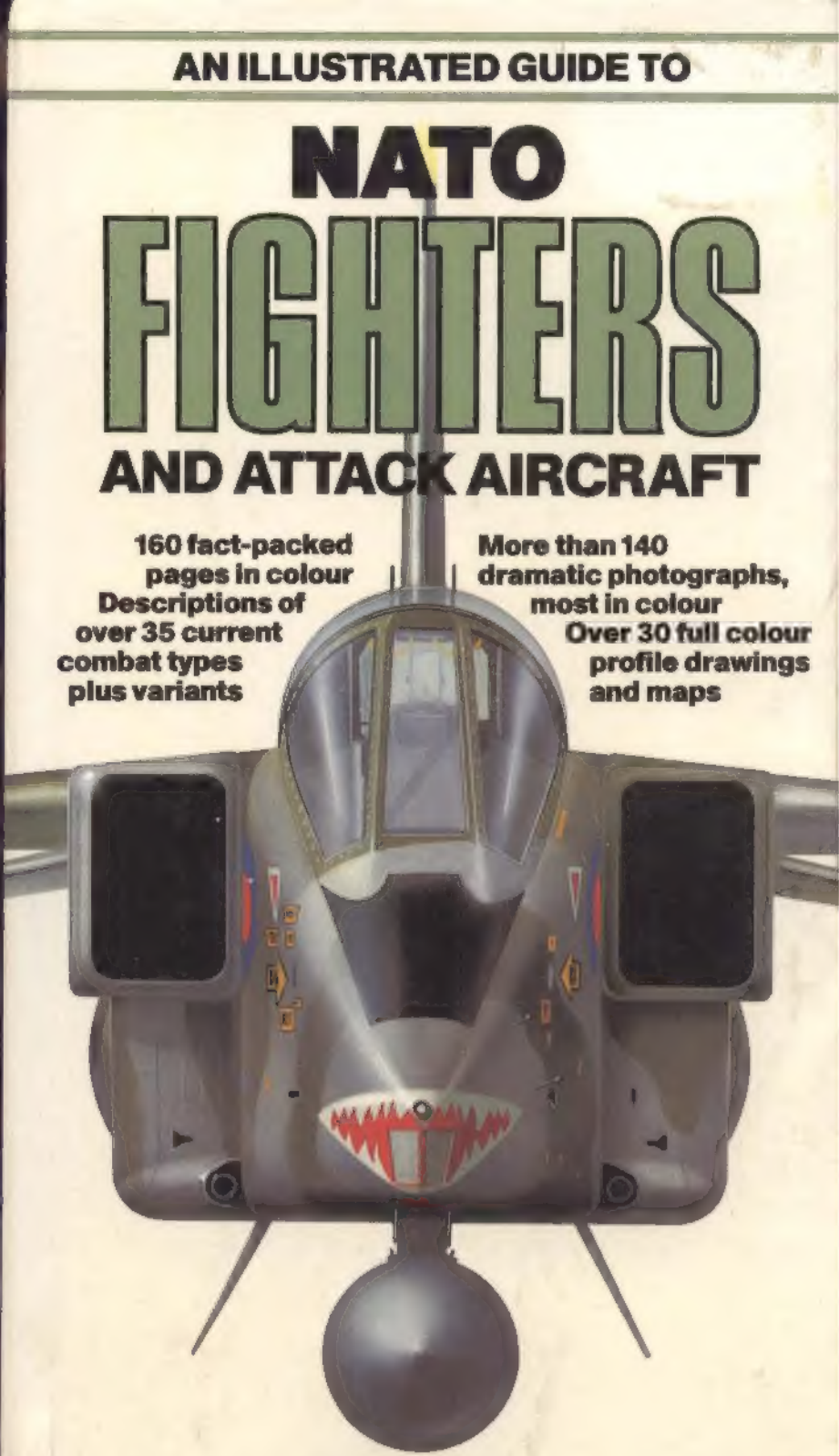
NATO FIGHTERS AND ATTACK AIRCRAFT

160 fact-packed pages in colour

Descriptions of over 35 current combat types plus variants

More than 140 dramatic photographs, most in colour

Over 30 full colour profile drawings and maps



Bill Gunston

632

UK Price
£3.95

AN ILLUSTRATED GUIDE TO

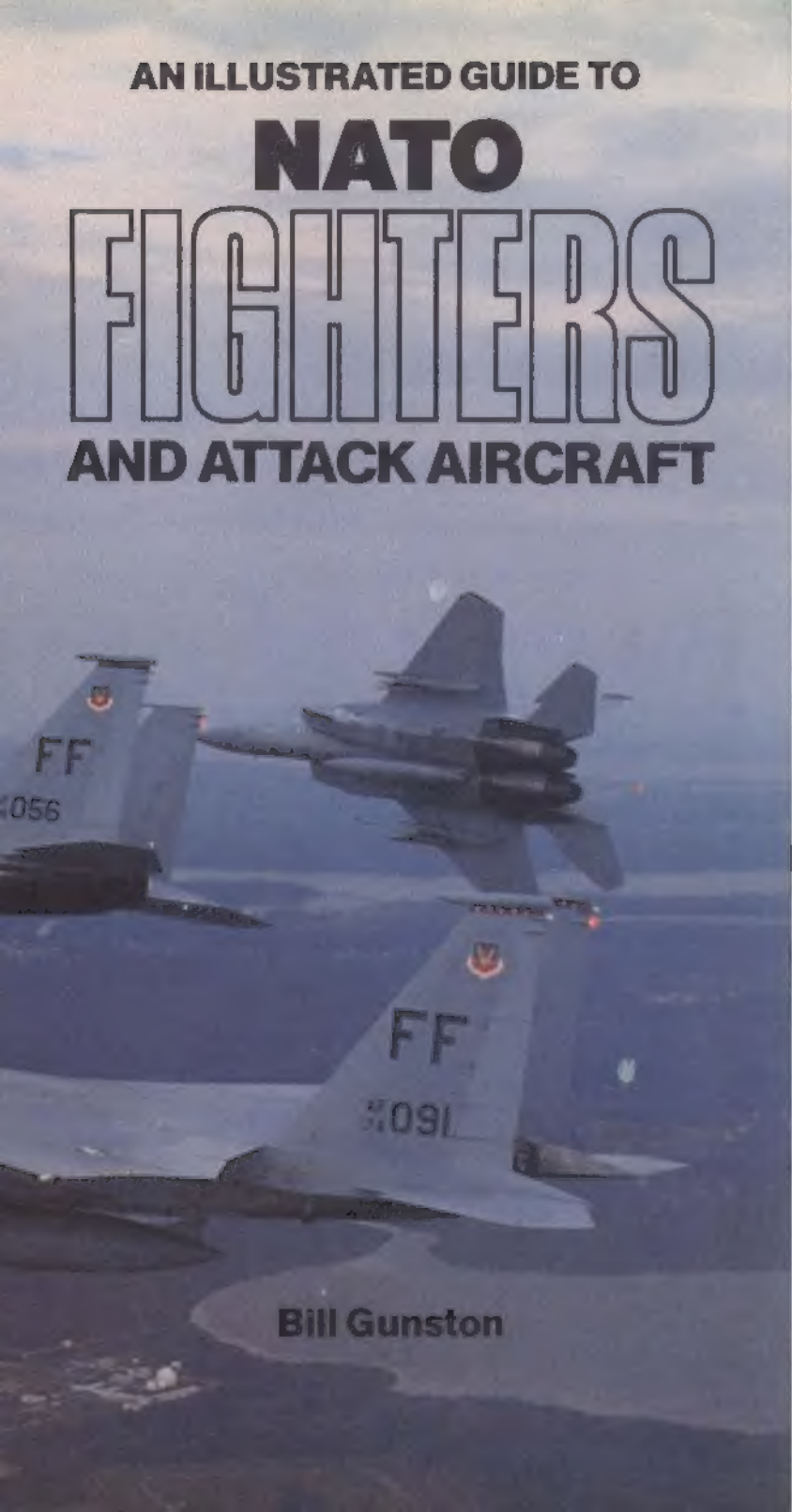
NATO FIGHTERS AND ATTACK AIRCRAFT

a Salamander book

Published by Salamander Books Limited
LONDON

AN ILLUSTRATED GUIDE TO

NATO FIGHTERS AND ATTACK AIRCRAFT



Bill Gunston

A Salamander Book

© 1983 Salamander Books Ltd.
Salamander House,
27 Old Gloucester Street,
London WC1N 3AF,
United Kingdom.

ISBN 0 86101 1651

Distributed in the United Kingdom
by Hodder & Stoughton Services,
PO Box 6, Mill Road,
Dunton Green, Sevenoaks,
Kent TN13 2XX.

Contents

Aircraft are arranged in alphabetical order of manufacturers' names.

Credits

Author: Bill Gunston, former Technical Editor of *Flight International*. Assistant Compiler of *Jane's All the World's Aircraft*.

Editor: Ray Bonds
Designer: Philip Gorton

Colour drawings: © Pilot Press Ltd., and by Mike Trim and Tudor Art Studios Ltd., © Salamander Books Ltd.

Map and markings: Jerry Scutts/ Alan Hollingbery, and TIGA, © Salamander Books Ltd.

Photographs: The publishers wish to thank the aircraft manufacturers, air forces and other international government archives, and private individuals who supplied photographs for this book.

Filmset by Modern Text Typesetting Ltd.

Colour reproduction by Rodney Howe Ltd.

Printed in Belgium by Henri Proost et Cie.

Introduction

THIS BOOK examines the aircraft which defend NATO's 600 million people, but not in the usual way, by studying how the aircraft were designed and developed; rather by relating them to the tasks they have to do, and the squadrons which use them.

The North Atlantic Treaty was signed, despite intense Soviet pressure, on April 4, 1949. The pressure was directed mainly at the Europeans among the original signatories, who were Belgium, Canada, Denmark, France, Iceland, Italy, Luxembourg, the Netherlands, Norway, Portugal, the UK and the USA. Greece and Turkey joined the alliance in 1952, and Federal Germany in 1955; in March 1966 France withdrew from the military alliance (while remaining politically and economically a member) and Spain became a full member in May 1982.

Throughout its life NATO has suffered greatly from the fact that it exists to protect countries which are completely free democracies. To any builder of military forces it is much easier to have an organization like the Warsaw Pact (which dates from 1955). Here there is only inhibited discussion, and certainly no argument with the Soviet Union; decisions are taken centrally and quickly, and the result is a continuing avalanche of weapons which are all modern, effective, standardized and produced at the lowest cost. NATO's position is different, even in such a high-cost, technologically difficult field as combat aircraft. Democratic people vociferously maintain their independence.

The past 30 years have repeatedly monstrated how difficult it is in a free society to get an efficient collaborative programme to achieve a standard product. The most common way has been for all the supposed junior partners in NATO to buy American, or participate in a multinational manufacturing programme run by the Americans for a US product, such as the F-104 or

F-16. Further US products which have been the subject of major NATO collaborative efforts include the E-3A (AWACS), Mk 44 air-launched torpedo, Bullpup ASM, Hawk SAM, Sea Sparrow naval SAM, and Sidewinder and AMRAAM AAMS. Most of the European collaborative efforts have either foundered, or sold to only a few (as in the case of Aeritalia G91, Atlantic, Jaguar and Transall). The Tornado, though not American, stands out as an almost unique example of a programme sufficiently large, and well-managed, to result in a really competitive product which will undoubtedly find wider acceptance.

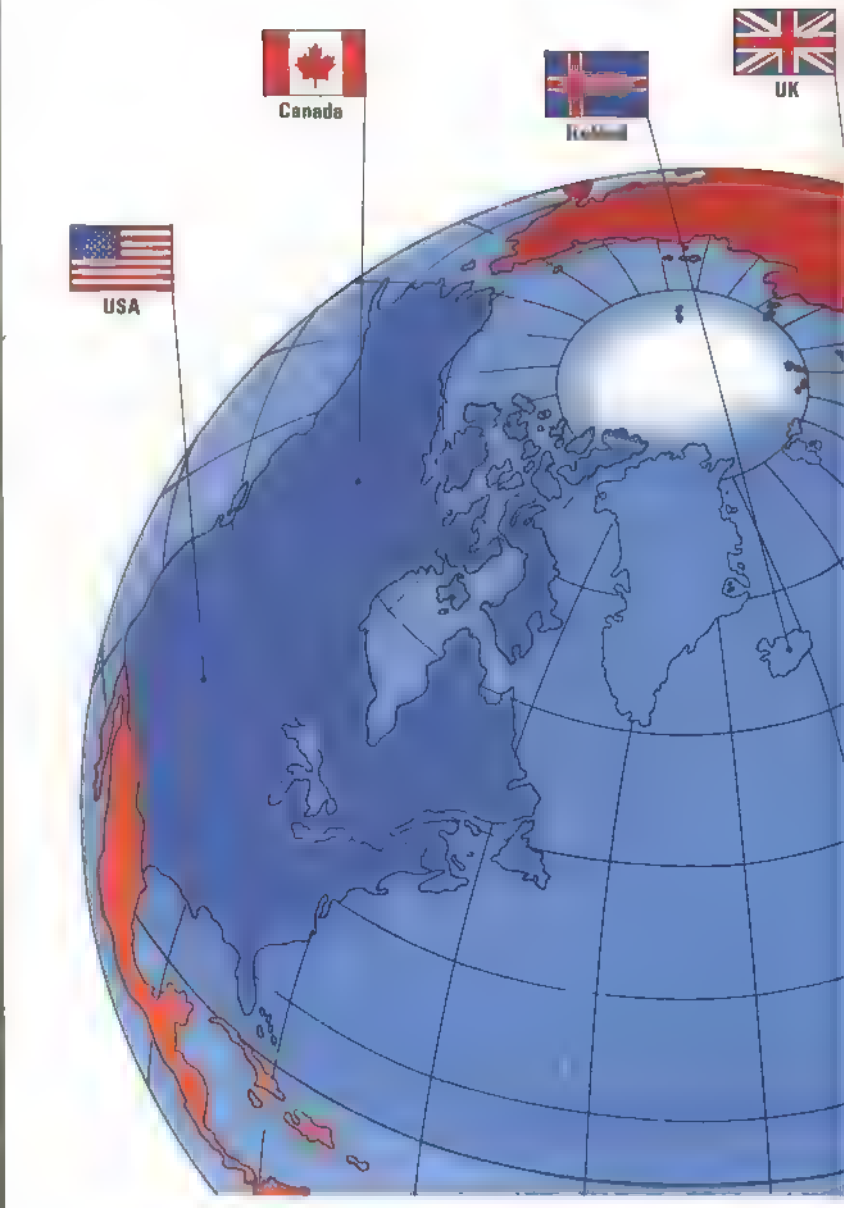
One of the stumbling blocks is that the USA, incomparably the dominant NATO power in industrial and political influence, is psychologically handicapped in multinational programmes. Such a programme based on a US product is easy to understand. A programme based on a "foreign" product is seen

Above: The Tornado F.2 is the supreme example of a modern NATO weapon system

primarily as competition. Even Tornado, which has never had any US counterpart other than the older and less-efficient F-111, had to survive a decade of American (and French) industrial and political history. It may be that, spearheaded by the bold and unilateral decision of the US Marine Corps to buy the Harrier, the much-vaunted "two-way street" in arms across the Atlantic may eventually take on some degree of realism.

Of course, there are examples of NATO military hardware which, by their very nature, were forced to be single integrated systems created on a collaborative basis. By far the largest in physical terms is NADGE (NATO air-defence ground environment), the single giant system of radars, computers, displays and communications which stretches in a 2,000-mile (3,200km) curve from northern Norway round Federal Germany and across the Mediterranean to Turkey's eastern frontier. Yet even here the superb grand design was flawed in the execution by nationalistic horse-trading, nationalistic technical weaknesses and other snags including a total inability to predict future rates of inflation. And, since NADGE was completed in the early 1970s, individual nations have added their own local bits, or even (in the case of Greece/Turkey in the summer of 1974) withdrawn their vital NADGE stations from the chain while they indulged in a fratricidal war.

Greece and Turkey were for both political and economic reasons two of the crucial nations when NATO was formed. They were the most in need of economic aid, and they were the most directly threatened by the Soviet Union. Not much has changed, and after 31 years in the alliance Greece remains a fragile member. Italy has a large population which habitually votes ▶



▶ Communist, and it is not long since Portugal underwent a leftist revolution that was led by the armed forces, notably the air force. Next door, Spain fears a coup by an army that is equally far to the right.

All these are natural problems of a free society. They make NATO's planning a thousand times more difficult. They are also what NATO exists to protect.

The NATO command structure

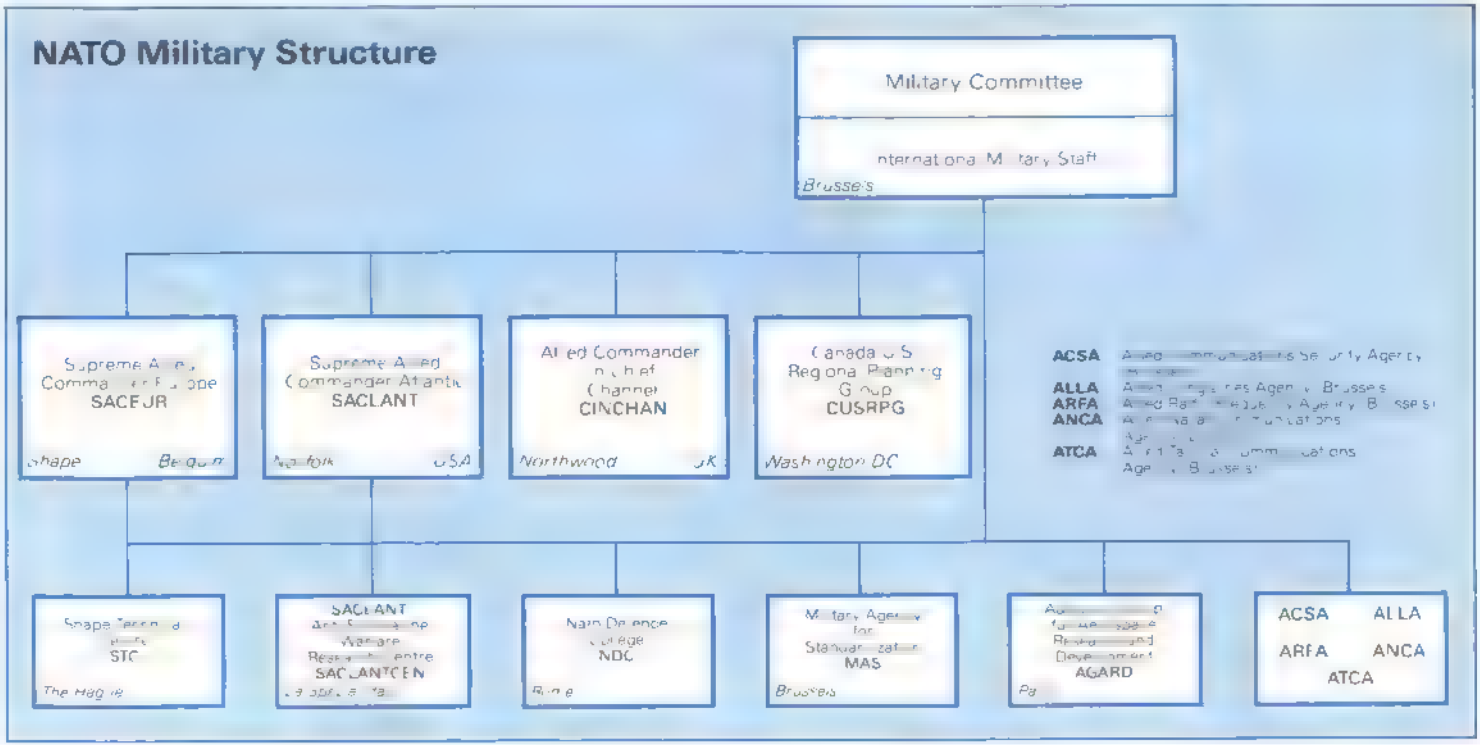
For 34 years NATO's thinking has been polarized around a military assault from the Soviet Bloc directed at Western Europe. This scenario may be erroneous, but all other theatres have been regarded as strategically secondary or less likely to be the scene of conflict. Thus, though North America still has

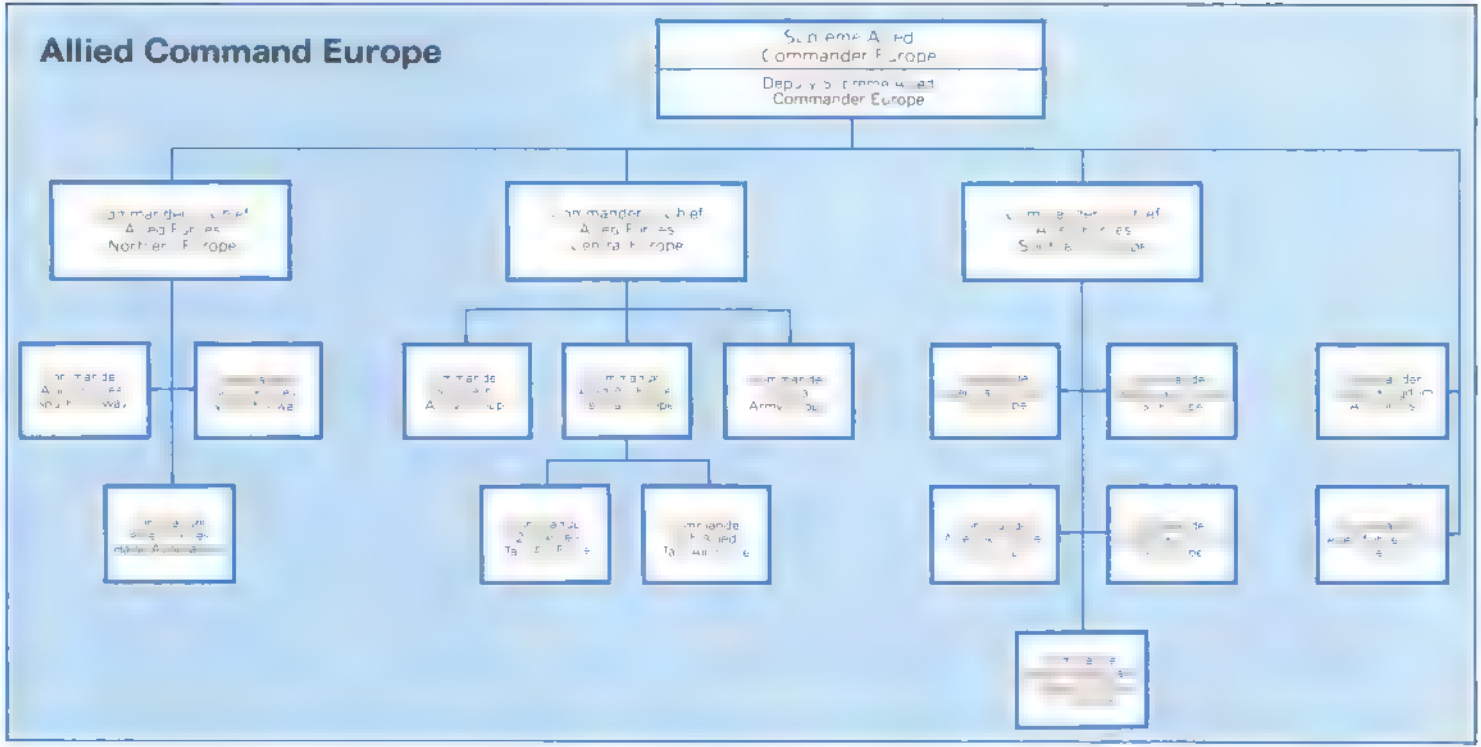
NATO's Sixteen Members and the Military Commands

powerful defences, for eventualities studied by the Canada/USA Regional Planning Group (which meets alternately in Washington and Ottawa), the only kind of attack on that vast territory that appears feasible is a nuclear assault by ICBMs and SLBMs.

This leaves three other NATO commands, each covering a particular geographical area, all of which would certainly be directly involved in any future European conflict. These are Allied Command Europe (ACE), Allied Command Atlantic (ACLANT) and Allied Command Channel (ACCHAN).

ACE is the largest and, it is assumed, most immediately threatened of these organizations. Its commander is called Saceur (Supreme Allied Commander, ▶


NATO Military Structure
Military Committee
Brussels
Supreme Allied Commander Europe
SACEUR
Shape Belgium
Supreme Allied Commander Atlantic
SACLANT
Norfolk USA
Allied Commander in Chief Channel
CINCHAN
Northwood UK
Canada US Regional Planning Group
CUSRPG
Washington DC
ACSA
ALLA
ARFA
ANCA
ATCA
STC
The Hague
SACLANTCEN
NDC
Rome
MAS
Brussels
AGARD
Paris
ACSA
ALLA
ARFA
ANCA
ATCA


Allied Command Europe

▶ Europe), and his HQ is at Shape (Supreme Headquarters, Allied Powers Europe), which is at Casteau, near Mons, Belgium Commands subordinate to Saceur are Allied Forces Northern Europe, Kolsoas, Norway, Allied Forces Central Europe, Brunssum, Netherlands; Allied Forces Southern Europe, Naples, Italy, the UK Air Forces Command, High Wycombe, England; and the AMF (ACE Mobile Force), Seckenheim, Germany

ACLANT is responsible for the largest geographical area Its commander is Saclant, and his HQ is at Norfolk, Virginia, USA His subordinate commands are Western Atlantic, Norfolk, Eastern Atlantic, Northwood, England; Iberian Atlantic, Lisbon, Portugal; and three naval commands including Striking Fleet Atlantic which includes powerful carrier air forces

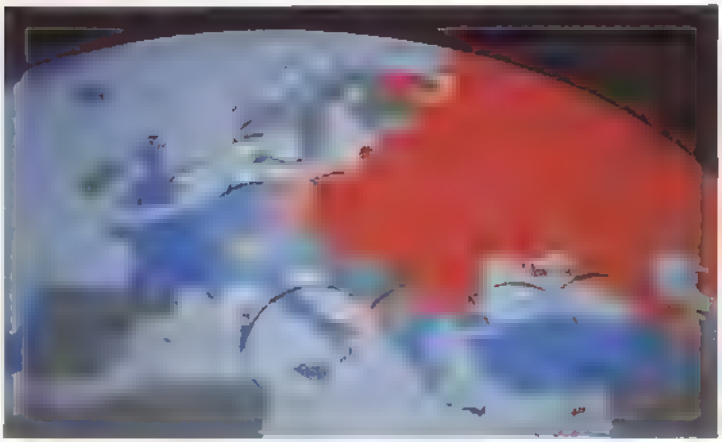
ACCHAN is responsible for the English Channel and southern North Sea Its commander, Cinchan, has his HQ at Northwood, and his commands are mainly naval but include Allied Maritime Air Force Channel Command

AFNE (Northern Europe) is geographically divided into zones but includes no separate air command AFCE (Central Europe) does contain separate air elements, and they are the most powerful in Western Europe the Commander of AAFCE (Allied Air Forces Central Europe) has his HQ at Ramstein, Germany, and he commands 2ATAF and 4ATAF The 2nd Allied Tactical Air Force comprises the tactical airpower of Belgium and the Netherlands, plus RAF Germany and part of the Luftwaffe, and its HQ is at Munchen-Gladbach The 4th ATAF comprises the remainder of the airpower of the Luftwaffe, plus the USAF and CAF (Canadian Armed Forces) airpower on the continent of Western Europe, and its HQ is at Ramstein AFSE (Southern Europe) does have a separate AAFSE (Allied Air Forces Southern Europe) command, and from Naples this controls the airpower of Italy (5ATAF), Greece (28ATAF) and Turkey, with Spain being integrated

Many other elements of European NATO airpower are nationally controlled, or assigned to a local maritime commander, or not assigned to NATO command at all Conversely, a few others wear two hats and can be called upon by more than one NATO commander

This book is concerned chiefly with hardware, and it is for reasons of tasking and command structure that it excludes such aircraft as the Lockheed P-3 Orion and S-3 Viking, even though these have plenty of "attack" capability

Sweden, Austria and Switzerland are not part of NATO, and have no



Above: The only tangible military defence system linking the NATO countries of Europe is Nadge, symbolized by 'radar hemispheres' (Artwork was prepared before Spain, shown in blue, joined NATO)

Above: Despite the near-abandonment of the US version, Roland remains a NATO SAM

p ace in this book France's air-power is included, though it is not assigned to NATO The B 52, Vulcan, B-1B and FB 111A are included because all might be important in a NATO context within this book's current life So might the AV-8B, and certainly the RAF Harrier GR-5, even though the latter is years away from service The ACA (Agile Combat Aircraft) however, is too nebulous to merit a place Helicopters are dealt with in a companion volume, *An Illustrated Guide to Military Helicopters*

Vulnerability of NATO bases

Before analysing in detail NATO's air forces and the aircraft they fly, it is important to look at some of the problems concerning a subject just as fundamental as the actual hard ware—where they are based

It is without doubt that its bases are the Achilles heel of any modern air force In World War II the Luftwaffe operated from front-line strips which, in a fluid battle situa tion, changed from day to day Today the Warsaw Pact air forces and the Swedish Flygvapen can in emergency vanish into countless preplanned locations using country roads and even unpaved surfaces as runways Even tiny Switzerland can in emergency disperse its small air force to a dozen strips with support facilities, including hangars, cut into the sides of mountains

NATO's formidable airpower seems to the casual observer, to be a colossal waste of money because it can be caught, at any hour of any day, on a pitifully small number of well known airfields

Certainly the NATO nations have made strenuous efforts to amelior ate the effects of conventional air attack on these bases Almost (but not quite) all have at least a machine gun pointing skywards Many have specialist flak troops with rapid-fire cannon (in a few cases radar-directed), and a few airfields are protected by locally emplaced SAMs

RAF Germany has a unit of the RAF Regiment at every operational airfield with eight towed Rapier fire units, which have been given blind-fire night/all weather facilities Rapiers of the RAF Regiment will defend USAF bases in the UK, and are expected to be ordered for bases of the 17th AF in Germany ▶

The French Armée de l'Air uses the Crotale SAM system in large numbers. Luftwaffe bases were to have had Roland fire units, these were cancelled and a scheme to use AIM 9L Sidewinder in a Chaparral-type installation is being studied, and the Luftwaffe's 216 Improved Hawk launchers are in some cases sited at airfields. A few NATO bases are protected to some degree by infantry-fired weapons notably Redeye and Stinger.

In addition there has been a major sustained effort to reduce the effect of attacking aircraft which do get through. By late 1982 almost every tactical aircraft in the front-line inventory of 2 and 4ATAF, and many RAF and USAF aircraft in the UK, were matched by a Hardened Aircraft Shelter. These are concrete-floored one plane huts constructed of reinforced concrete to any of (usually) three standard designs, with heavy end doors, intended to offer protection to the interior against direct hits with bomblets and weapons up to about 220lb (100kg) size, and against near misses with pavement cratering or larger bombs.

In time of crisis as many aircraft as possible would spend as much time as possible inside shelters, or airborne. Further effort and cost have been devoted to the quick repair of runways and other pavements cratered by air attack. All personnel have NBC clothing.

Such measures are no more than prudent commonsense. But nothing appears to have been done to address the problem which, to the author, renders the whole of NATO's airpower (except perhaps the Harrier) a most fragile asset.

It is common knowledge that to the Warsaw Pact nuclear (and indeed other unconventional) arms are no big deal, they are just a particular range of options to be used as and when ordered. All WP troops undergo simulated nuclear and chemical warfare training surpassing anything attempted in the West. Yet it would be NATO and not the WP, who would be on the receiving end.

At a quick count the Soviet tactical forces alone could fire 4,700 nuclear warheads with accuracy far better than the size of an airfield in the first few minutes of any conflict against Western Europe, and without touching any

Below: Patriot promises to be the greatest-ever SAM; but at what a cost in time and money!

Above: A French Jaguar outside a hardened shelter. Runways are vulnerable, though.

of the strategic weapons of the RVSN (Raketnye Voiska Strategicheskogo Naznacheniya—Strategic Rocket Forces) NATO has no known defence against such an attack, and as 98 per cent of NATO's European combat airpower is to be found on a total of 69 bases there would be around 4,631 missiles left for a second strike.

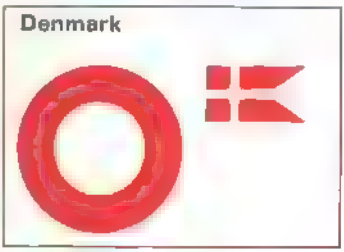
Perhaps the simple answer is that, as NATO has announced no answer to this obvious threat, it prefers to ignore it. Such an ostrich posture appears difficult to justify when one considers the financial burden imposed on Europe's taxpayers by the aircraft featured in this book. It may be that it is tacitly assumed in NATO circles that the WP forces would only use nuclear weapons as a last resort, and so we find such assessments as those made from time to time by Western analysts who recently calculated that 89 per cent of NATO's European airpower would still be operating on the third day of World War III! In the author's view less than 5 per cent would be operating after the pre-emptive strike which would *precede* such a war.

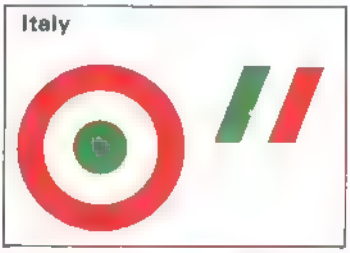
It might not be a bad thing if NATO could take an hour or two off from its cosy assessments of how its sophisticated modern aircraft stack up against the supposed crude and outdated aircraft of the Warsaw Pact (it appears to be instinctive to undervalue Soviet hardware until we find out more about it), and instead address itself to the problem of how to make those expensive aircraft survive longer than five minutes in any European war situation.

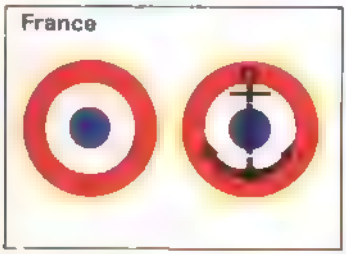
For a start we could add a zero and possibly two zeros, to the total of 69 major operating locations. To prepare 6,900 adequate airstrips without causing aggravation to Western Europe's farmers or environmentalist groups, is not as ludicrously impossible as it sounds. Even in the tight little isle of Britain there are over 1,400 former airfields, many of which still have the basis of a paved runway. The rest of Europe provides quite a lot of real estate heavily sprinkled with former airbases.

Dispersal is more cost-effective than hardening, and is good against nuclear attack as well. We are not talking about properly equipped bases, merely locations to which aircraft could be temporarily dispersed, and where convincing dummies able to fool multispectral surveillance could be located.

Yet for years NATO has done just the opposite and concentrated more and more airpower on fewer and fewer bases. Italy's AMI, for example, has completely abandoned the idea of "one gruppo, one base" ▶



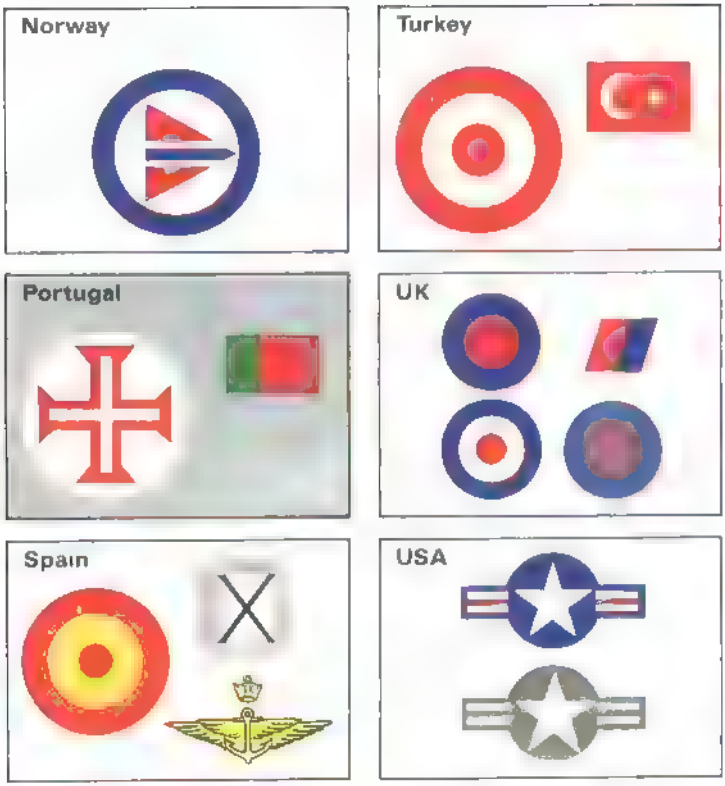




▶ and cut the number of operational airfields since 1975 from 95 to 20, of which only 11 are effective Belgium has four and the Netherlands three. Can this really be considered viable airpower?

The present situation seems to be based on the groundless belief that the Soviet Union would not use its tactical nuclear missiles against NATO airfields. These are surely the very first and most obvious facilities against which these missiles must already be targeted

Even the RAF's Harriers can be caught at just two airfields! Has the RAF done its homework and readied 100 remote sites where Harriers could quickly be dispersed, and where the takeoff run ends in a natural ski-jump? Apart from HMS *Invincible* (which was almost sold) and *Illustrious*, the only elements of NATO airpower in the European theatre which appear to have a chance of actually participating in the defence of Western Europe are those aboard the one (or two) carriers of the US Sixth Fleet, which do not stay in the same place



Some of the insignia carried by NATO military aircraft has not changed in 60 years, but two of the technical leaders, the UK and USA, have lately conducted prolonged studies into whether such markings have much value. The so-called B-type roundel and fin flash, which eliminates white, was first used on RAF night bombers almost 60 years ago, and not only has it been restored but in the Falklands campaign the colours were toned down further (lower right UK roundel). For the same reason the regular US marking is being replaced on combat aircraft by a monochrome insignia in black or, more often, medium grey to reduce contrast

Air forces of the NATO nations

The following is an alphabetical listing of NATO air forces as they impinge upon NATO. Iceland has no armed forces and at most NATO committee meetings votes with the majority by leaving its chair vacant. Luxembourg plays a much more active part in the Alliance, but again has no airpower (though, for purely legal reasons, the NATO fleet of 18 Boeing E-3A Sentry AWACS aircraft are registered as the property of the Grand Duchy).

Belgium

Virtually the whole of the nation's airpower is vested in the FAB (Force Aérienne Belge), or, in Flemish, the Belgisch Luchtmacht, which is part of 2ATAF. It has six main operating bases: Beauvechain (F-16, with F-104Gs still being replaced), Florennes (Mirage 5BA), Bierset (Mirage 5BA), Kleine Brogel (F-16, with F-104Gs being replaced), Brussels-Melsbroek (transports) and Brustem (trainers, including Alpha Jets). The ALFT (army light aviation) has helicopters plus seven fixed-wing Defenders ▶

▶ The FNB (navy) has Alouettes

Canada

Since 1975 there has been a single unified CAF (Canadian Armed Forces), or Forces Armées Canadiennes. Within the Dominion the CAF includes a large cross-the-board spectrum of airpower organized into an Air Defense Group, a Tactical Air Group, a Maritime Air Group, an Air Transport Group and an Air Reserve Group. From NATO's viewpoint the most important of these forces are the 18 CP-140 Aurora shore-based patrol/ASW aircraft and the 35 ship-based CH-124 Sea Kings. In Europe, however, Canada has since World War II maintained an important tactical presence, currently termed No 1 CAG (Canadian Air Group)

The combat element comprises 77 CF-104s tasked with offensive air-support missions as part of 4th ATAF, normally based at Baden-Söllingen, Germany Some of these aircraft, and 20 CF-104D two-seaters, serve with 417 Sqn, the OCU at Cold Lake, Alberta. At Lahr, Germany, are two CC-132 Dash 7s assigned to 412 Sqn (the rest of 412 is at Uplands, Ottawa) and the 11 CH-136 Kiowa helicopters of 444 Sqn

Denmark

Typical of NATO's language difficulties is the fact that RDAF (Royal Danish Air Force) is an accepted NATO title, whereas this force is actually the KDF (Kongelige Danske Flyvevaben), or Flyvevabnet (Flyvevaabnet) for short Its tactical force is a single Flyvertaktisk Kommando, or in NATO language Tacden

It comprises one squadron (Esk 723) of F-16s and one (Esk 726) of F-10s at Aalborg, two of F-35 Drakens (725, 729) at Karup and two of F-16s (727, 730) at Skryd strup Each of these Eskadriller has a nominal complement of 20 aircraft, rather than a more usual 16, because they contain two-seaters to meet the training requirement following the disbandment of training command in 1970 Other forces include C-130 and S-61 transport/SAR aircraft at Vaerlose and good coverage with Nike Hercules and Hawk SAMs Primary training is done on T-17 Supporters, a type also used by the small Haerens Flyvetjeneste (army flying service) along with Hughes 500M helicopters. The navy flies Lynx and Alouette helicopters

France

Strongly nationalistic, and thus a frequent stumbling-block in international programmes (unless she can appear to be the leader of the project), France has from the outset been a full member of NATO. In 1966, however, she withdrew from the military command structure, and her forces are thus under purely national control

Unlike all other W European powers, the French army, navy and air force all deploy substantial nuclear firepower, the air force (l'Armée de l'Air) being responsible not only for the recallable Forces Aériennes Stratégiques (FAS) with manned bombers, but also for the 1e Groupement de Missiles Stratégiques (GMS) with two squadrons each having nine silos loaded with S3 missiles of up to 3,300km (2,050 miles) range The FAS received 62 Mirage IVA supersonic bombers but now deploys an effective force of 32 divided into two escadres (wings) with strong tanker support and maximum dispersal

Cafda (Commandement Air des Forces de Défense Aérienne) still has an EC (escadre de chasse, fighter wing) at Creil, north of Paris, flying the 20-year-old Mirage IIIC; the other three ECs fly the Mirage F1 and may later equip with the Mirage 2000

Catac (Commandement Aérien Tactique) is much larger and comprises four ECs of Mirage IIIs and 5s, four of Jaguars, an ER with Mirage recon aircraft and a training EC with Alpha Jets. One EC, No 2 at Dijon, is to re-equip with the Mirage 2000 from 1984. The rest of l'Armée de l'Air comprises large transport and training forces, and an AWACS-type platform is being sought

The Aéronautique Navale will soldier on well into the '90s with its

two ex-RN wartime carriers in which are embarked Super Etendard attack aircraft, the ASW Alizé, Atlantic/ANG and Falcon Gardian patrol aircraft are outside the scope of this book, as are the large helicopter and light-fixed-wing forces of Alat (Aviation Légère de l'Armée de Terre, light aviation of the army

Germany (FDR)

Largest and best-equipped of the European NATO nations, West Germany has a powerful Luftwaffe assigned partly to 2ATAF and partly to 4ATAF, the army and navy also deploy substantial air forces subordinate to national ground and naval commands (which are themselves assigned to NATO)

A new air-combat fighter has long been sought to back up the F-4F which equips two JG (fighter wings) and two JaboG (fighter/bomber wings). Four JaboG of F-104s are progressively being replaced by Tornadoes, and the two AG (recon wings) of RF-4Es are acquiring offensive power by equipping these aircraft to fly precision attack missions Three JaboG (41, 43 and 49) have equipped with the Alpha Jet in the light-attack role, together with a training unit at Beja, Portugal. Dual Tornadoes equip the TTTE in England and a WS (Waffenschule, weapon school) at Erding in Germany Hansa Jets are used for ECM training and VIP liaison, and numerous T-37s, T-38s

Above: Marineflieger Tornado with MW-1 bomblet dispenser.

F-4s and F-104s fly in the USA as trainers A few of the once vast fleet of F-104s are flying in the attack, training, recon and ECM roles

Slightly different Tornadoes are the chief combat type of the Navy's Marineflieger progressively equipping two MFG (navy air wings) other MFGs fly the Atlantic (some in the EW role), Sea King and Lynx The Army Heeresflieger operates hundreds of helicopters, chief types being the anti-tank BO 105P UH-1, CH-53 and Alouette

Greece

The Ellinikí Aeroporia has, with the Turkish AF, always been one of NATO's problem areas; indeed the nation was not even an active NATO member in 1974-80 The El's combat strength, part of AFSE is the 28th Tactical Air Force, made up of seven pterighe (wings). Each of these has a liaison flight of T-33s and AB 205s, but the combat strength comprises the following 110a Pterix, Larissa, one mire (sqn) each of A-7H, F-4E and mixed RF 4E/RF-84F; 111a, Nea Ankhialos, two mire F-5A/B, 113a, Thessalonika-Mikra, one mire F-5/RF-5; 114a, Tanagra, two mire Mirage F1-CG with Magic AAMs 115a, Soudha Bay, two mire A-7H with AIM 9L self-defence AAMs, 116a, Araxos, two mire F/TF-104G, ▶

▶ and 117a, Andravida, two mire F-4E. The EI has many secondary types, including C-130s and T-2E jet trainers The army and navy fly mainly helicopters

Italy

The AMI (Aeronautica Militare Italiano) provides the bulk of 5ATAF, and has a substantial force of effective and aggressively flown aircraft despite sustained—indeed worsening—problems caused by a critical shortage of money, a poor national economy and a frequently changed government teetering on the brink of a Communist majority

Its main combat strength is organized into 12 stormi (regiments) each comprising one or two gruppi (squadrons) ostensibly of 16 to 25 aircraft but effectively shrunk to 12 to 18 Thus the order of battle reads (in numerical stormo order): 2 Stormo, Treviso, two gruppi G91R, 3S, Verona, two gruppi F/RF-104, 4S, Grosseto one gruppo F-104S, 5S, Rimini, two gruppi F-104S, 6S, Ghedi, one gruppo (No 154) Tornado, 8S, Cervia, one gruppo G91Y, 9S Grazzianise, one gruppo F-104S 14S, Pratica di Mare, two gruppi MB 326, MB 339, PD 808 and G222, all ECM platforms, 32S, Brindisi, one gruppo G91Y, 36S, Gioia del Colle, two gruppi F-104S in strike role, one (156) being part-converted to Tornado, 51S, Istrana (Treviso), two gruppi F-104S, one about to convert to Tornado, and 53S Cameria, one gruppo F-104S interceptors

Two gruppi fly Atlantics in the ASW role under the control of the Marinavia, which flies helicopters The ALE (army light aviation) has large forces of helicopters, and a few fixed-wing lightplanes

Netherlands

The KLu (Koninklijke Luchtmacht) has a number of built-in headwinds, such as an officially recognised trade union for its other ranks, but manages to deploy effective air-power as part of 2ATAF, using three types of fighter and four airfields

At Leeuwarden are squadrons Nrs 322 and 323 equipped with the F-16, at Volkel are Nr 312, with the last F-104Gs, and Nrs 306 (tac-recon) and 311 with F-16s, at Gilze Rijen are Nrs 314 and 316 with NF-5As, and at Twenthe is 315 with NF-5As and also Nr 313 the pilot OCU with the NF-5B In the later part of the decade the KLu combat strength will rest on one type, the F-16 Pilot training to wings standard is done in Canada and the USA

The Marine Luchtvaartdienst operates Orions, Atlantics and Lynx

Norway

The KNL (Kongelige Norske Luftforsvaret), styled RNorAF in NATO English-language publications, is another NATO force which will

Below: Few would dispute that the F-16 (KLu aircraft shown) is ideal for Western Europe.

probably soon rely entirely on the F-16 for its tactical firepower. 331 Sqn flies the F-16A/B from Bodo, 332 flies the same mix from Rygge, 334 is converting from Bullpup-armed F-104Gs in the anti-ship role to the F-16 which will eventually carry the locally produced Penguin 3 missile, 336 still operates F-5As, as well as the camera-equipped RF-5As passed on by disbanded 717 Sqn, and 338 flies F-5As from Orland. The missing numbers are 333 (P-3B Orions) and 337 (Lynx), while 718 is a training squadron with F-5Bs.

Portugal

The FAP (Forca Aerea Portuguesa) has been quite literally the poorest in Western Europe, and it makes no contribution to NATO whatsoever. It once had a "squadron" of four SP-2H Neptunes (ex-Netherlands KLu) which operated as part of ACLANT and has been trying to replace these with P-3 Orions ex-USN.

The only modern fighting aircraft are 20 A-7P Corsair II attack machines which are refurbished ex-USN A-7As fitted with A-7E avionics; they equip Escuadra (squadron) 302 at BA-5 Monte Real, replacing F-86 Sabres. Another 30, including six two-seaters, may be on the way by the time this book appears. The only other significant force is at BA-6 Montijo, where Grupo 52, Esc 301, uses ex-Luftwaffe G91Rs armed with Sidewinders to hold the fort in the intercept role until a fighter can be obtained.

Other equipment includes C-130s, CASA Aviocars and helicopters, and in 1982 it was unofficially stated that the FAP was negotiating for five Brazilian EMB 111 coastal surveillance aircraft.

Spain

Details have not yet emerged of how, if at all, Spain's airpower will be assigned to NATO command, but it is considerable. The EdA (Ejercito del Aire, army of the air) organizes its combat strength into four commands (manda).

El Mando Aéreo de Combate has fighters for home defence, controlled by the Combat Grande (Nadge type) defence system and comprising Esc (Escuadron) 111 at Manises (Mirage III, to be replaced from 1986 by F-18s), Esc 121 at Torrejon (F-4CR and RF-4C), and Esc 141 at Los Llanos (Mirage F1 CE).

El Mando Aéreo Tactico has Esc 211 (SF /SRF-5A/B) and Esc 214 (HA 220 Super Saeta) both at Morón in the attack role and Esc 221 with Orions.

El Mando Aéreo de Canarias (Canary Islands) has a base at Gando housing Esc 462 (Mirage F1 CE) and Esc 464 (SF-/SRF-5A/B) as well as squadrons flying Aviocars, Super Pumas and other types.

El Mando Aéreo de Transporte flies C-130s, KC-130 tankers and other types.

The Arma Aérea de la Armada (naval air force) has Esc 008 equipped with AV-8A/TAV-8A Harriers, due for replacement from 1987 by AV-8B Harrier IIs. Other types include AH-1G Cobras, Sea Kings and ASW Agusta Bells.

Turkey

Despite its terrible economy, this enormous country is so vital, so threatened and possessed of such military manpower that, with help from other NATO members, it has built up a tactical air force of considerable strength. In bygone years it was a dumping ground for what everyone else cast off. The process continues, and the hangars are jammed with surplus F-100s, indeed even the F-104Gs have been arriving in such numbers that not all of them have yet been put into service with a pilot to fly them, but most of these have actually been paid for (albeit at little more than scrap value), and Turkey bought its F-104S force new from Aeritalia.

As this book is written, in early 1983, Turkey's wish to buy, or better still build, F-16s has not been settled. Tusas, the proposed Turkish aircraft industry, has been argued over for 13 years, and has at last made a modest start with the industrial partner most willing to ▶

▶ help, Northrop (other companies agreed with the American who said "The world needs another planemaker like it needs a hole in the head") The first licence-assembled F-5E finally rolled out in 1982, two years late, and Tiger IIs should replace F-5A/B aircraft by 1987

The THK (Turk Hava Kuvvetleri) deploys its fighting strength in two TAFs. The 1st Tac Air Force comprises: 111 Filo (sqn), F-100C/D/F, 112, F/RF-5A, and 113, F/RF-4E, all at Eskisehir, 131, 132, both with F-100 (being replaced by F-104) at Konya, 141, F-104G, and 142, F-104S interceptors, both at Murted, 161, F-5A/B, and 162, F-4E, both at Bandirma, and 191, F-10-4G, and 192, F-5A/B, both at Balikesir The 2nd TAF (no relation to 2ATAF) has 151, 152, F-5A/B, at Merzifon, 171, 172, F-4E, both at Erhac-Malataya, and 181, F-5A/B, 182, F-104S and 183, RF-5A, all at Diyarbakir

Air Support Command has both Transalls and C-130s, the navy still uses S-2 Trackers as well as helicopters, and the army has both helicopters and fixed-wing but has so far not managed to build anti-tank Tow-Defenders

United Kingdom

The sudden Falklands conflict both arrested the previous pattern of "defence cuts" and reminded the MoD that it must never be 100 per cent polarized around NATO This should do the RAF and Fleet Air Arm a power of good

The RAF's airpower is divided into RAF Germany and Strike Command The former, a major element of 2ATAF with HQ at Rheindahlen, comprises two squadrons (3 and 4) of Harriers, 2, 17, 20 and 31 of Jaguars, 15 and 16 of Buccaneers, and 19 and 92 of Phantoms

Strike Command comprises four groups No 1 (Bomber) Group has lost virtually all of its Vulcans, apart from six K 2 tankers, the six squadrons progressively re-equipping with the Tornado GR 1. Nos 12 and 216 Sqns fly Buccaneers in maritime attack, and with updating the former two units may go on throughout the decade. Two squadrons (55, 57) fly Victor K 2 tankers Canberras, Nimrod R 1s and electronic warfare expertise is concentrated at Wyton, where there is a small photo-recon unit (replacing No 39 Sqn) with Canberra PR 9s No 11 (Fighter) Group has 23, 29, 56 and 111 flying Phantoms, with 64 serving as the OCU, and No 43 on the ex-RN Phantom FG 1, 5 and 11 will fly Lightnings until 1985, and in 1983 No 8 was to trade its aged Shackletons for Nimrod AEW 3s

In 1984 No 11 Group will be merged into No 1 No 18 (Maritime) Group flies Nimrods and helicopters No 38 Group is the UK's Rapid Deployment Force, comprising 1 Sqn, Harriers, 6, 41 and 54 Jaguars, and 63, 79 and 234 with Hawks (and a few Hunters), about 90 of the Hawks being tasked not only with attack training but also, with AIM 9L Sidewinders, with defending UK airspace Among 38 Group's varied transport force is the squadron of VC 10 K 2 and K 3 tankers

The Fleet Air Arm's Sea Harrier squadrons (800, 801 and 899) all fought over the Falklands; one more will be formed when 14 additional aircraft are delivered. The remainder of the FAA, and most of the AAC (Army Air Corps) and Marine Commando Air Squadrons, are rotary-wing.

USA

American airpower is deployed among the USAF (across the board, and including all global or inter-theatre force), the USN (shore-based and seagoing, the latter organized into 13 extremely powerful Carrier Air Groups), the USMC (limited to close-support and supply of amphibious forces) and USA (rotary-wing on a gigantic scale, with very small fixed-wing strength notably including about 200 OV-1 Mohawks).

President Reagan has restored an improved B-1 as a weapon for the inventory, restored the C-5 as a production aircraft (with extra KC-10s) instead of the new C-17, and created a Rapid Deployment Force for swift transport to trouble spots. There is no room in this book for a detailed breakdown of even the combat units of the USAF (the reader is referred to the companion volume, *An Illustrated Guide to the Modern USAF*).

The most important US airpower to European NATO nations is USAFE (US Air Force Europe), which is a separate Air Force command organized into the 3rd, 16th and 17th Air Forces and with HQ at Ramstein AB Germany, and bases in Germany, Greece, Italy, the Netherlands, Spain, Turkey and the UK.

The 3rd AF has HQ at Mildenhall, England, and includes the 10th TRW (RF-4C and TR-1, with 17th TRW as support unit) and 527th TFT "Aggressor" Sqn (F-5E) at Alconbury, the 20th TFW (F-111E) at Upper Heyford, the 48th TFW (F-111F) at Lakenheath, the 81st TFW (A-10A) at Bentwaters/Wood- ▶

Below. Without this aircraft the recovery of the Falklands would have been impossible.

▶ bridge, with detachments at six forward bases in Germany, and the 513th TAW (C-130, EC-135 etc) at Mildenhall, support units at Mildenhall manage KC-135s rotated to Mildenhall/Fairford and various other types including occasional SR-71s. At Woodbridge the 67ARRS (HC-130, HH-53) provides SAR for the whole of USAFE.

The 16th AF has HQ at Torrejón AB, Spain, and includes the 401st TFW (F-4C) at Torrejón and 406th TFT wing (a holding unit) with F-4s, A-10s and F-15s at Zaragoza with support for visiting KC-135s.

The 17th AF has HQ at Sembach AB, Germany, and includes the 26th TRW (RF-4C) at Zweibrucken, the 32nd TFS (F-15) at Camp Amsterdam, Soesterberg, the 36th TFW (F-15) at Bitburg, the 50th TFW (F-16) at Hahn, the 52nd TFW (F-4D/F-4G) at Spangdahlem, the 86th TFW (F-4E, T-39) at Ramstein, the 435th TAW (C-9, MC-130E) at Rhein-Main, the 601st TCW (O-2, OV-10, TR-1, CH-53) at Sembach and various support units.

The US Navy airpower is based chiefly in the continental USA, or afloat in the Pacific or Atlantic Fleets, but the C-in-C US Navy Europe (HQ, London) has major subordinate forces including the Sixth Fleet (Gaeta, Italy) and Fleet Air Mediterranean (Naples) while aircraft from other commands often visit Europe. Fleet Air Med manages patrol squadrons (mainly P-3C, EP-3E) on TDY at Rota, Spain, and Sigonella, Sicily, while transport squadron VP-24 supports the Sixth Fleet with C-130Fs, CT-39Gs and COD C-2A Greyhounds.

The US Army has substantial helicopter forces in Germany but none of its fixed-wing types appear in this book. Readers are referred to Salamander's *The US War Machine*.

NATO's future aircraft

Included in this book are all the manned fixed-wing fighter and attack aircraft of which details are known and which are planned to enter NATO service during the 1980s. Modern combat aircraft take a long time to design and develop. One has only to recall the apparent surprise of Western defence analysts at the "primitive" nature of the MiG-25 Foxbat which was examined at Hakodate Airport in September 1976 to see that this basic fact is often forgotten. The analysts should have remembered that the MiG-25 was flying prior to 1965 and therefore must have been designed prior to 1960, so of course its fundamental technology was that of the 1960s and not that of 1976.

Not only amateur enthusiasts but also the professionals in military airpower often overlook the vital time factor. What we do today cannot have much effect until the 1990s. The airpower NATO deploys today is because of decisions taken not in the 1970s but the 1960s.

There is an almost childish

Below: Little credence need be given to futuristic strike fighters—even from Boeing!

Above BAe Warton's mock-up of an Agile Combat Aircraft at least has some funds behind it.

amount of fashion in the design of combat aircraft—or perhaps it would be fairer to the designers to say there is fashion in the specifications written by the air staffs In the 1950s aircraft first had to exceed Mach 1, then Mach 2, and by 1957 the richer nations went for Mach 3

Odd man out was Br tain, wh ch in 1957 unilaterally announced that manned combat aircraft were obsolete and that the RAF was "unlikely to require" any to follow the Lightning, which with extreme reluctance was permitted to continue "because it has gone too far to cancel"

After 1960 everything had to be V/STOL—and very sensibly too, because airfield-based airpower is simply meaningless—but, partly because V/STOL tended to mean using British engines, this was effectively withered by the USA, and in particular by the USAF, though the Marines managed to keep one small branch still alive

The mind boggles at the thought of American taxpayers forking out 30 billion dollars for F-15 Eagles alone, every single one of which (except for the few which happen to be in the air) can be wiped out at the touch of a few Russ an buttons

Giving aircraft swing-wings helps greatly because this cuts down the field length by about half This was fashionable in the West in the 1960s, but today is regarded sensibly only by the bad guys who fly their tactical aircraft from places other than airfie ds By the 1970 era fashion had switched to the acronym RPV, because it is easy to demonstrate that a remotely-piloted vehicle can outfly any equivalent aircraft burdened by a heavy man in a heavy ejection seat in a heavily protected cockpit

Today we are almost back to square one, with combat aircraft that don't have to have supersonic performance, or V/STOL, or swing wings or remote pilots

s it not remarkable that the USAF, the world leader in combat-aircraft technology, can not only forget about V/STOL but also equip squadrons in Europe with a new and extremely costly tactica reconnaissance aircraft which flies no faster than a Spitfire, while its future long-distance bomber, de- ▶

signed to penetrate a thousand miles into hostile territory, should retain supersonic performance and swing wings only because it would cost even more to eliminate these features?

The new buzz-word is "stealth" to describe a wide range of shapes, coatings and technologies to try to make aircraft invisible to the enemy The invisible aircraft was fashionable in the early 1930s, and the Russians even tried to build one Today by "invisible" is meant having a minimal radar signature; how far stealth technology is also concerned with the suppression of IR emissions has received less public discussion, but clearly the ideal future combat aircraft has to try to be as invisible as possible over as much of the electromagnetic spectrum as possible We are thus concerned with longer wavelengths such as radar (which today gets down to the millimetric waveband) and with the much shorter wavelengths of IR (heat) and visible light

There is no doubt whatsoever that stealth technology, at present applied only to a single extremely sophisticated strategic bomber being developed chiefly by Northrop for USAF service after 1990, will gradually become the central feature of all military aircraft

Present preoccupation with turn radius, SEP (specific excess power, a measure of spare propulsive energy) and agility will cease to be very important because future missiles—fired from other aircraft or from land or ship launchers—will clobber all aircraft, irrespective of how good or bad they are in these matters

In the past, traditional dogfight manoeuvrability has been important in preventing the bad guy from ever getting within "parameters" (a position from which he can successfully launch a missile or engage with a gun). Thanks to digital microelectronics about the size of a pack of playing cards, future AAMs will find their target provided it is within range, even if they are launched in the wrong direction entirely. The RAF's belief in a self-defence AAM fired to the rear is based on a naive belief that the fighter of the 1990s will have to get on its opponent's tail

At present we are witnessing the last chapter in the long history of manoeuvrable fighters. The USAF professes still to be polarized around agility, as witnessed by the Grumman X-29A with its swept

Below US DoD sketch of an FSW (Forward-swept wing) combat aircraft for 1992

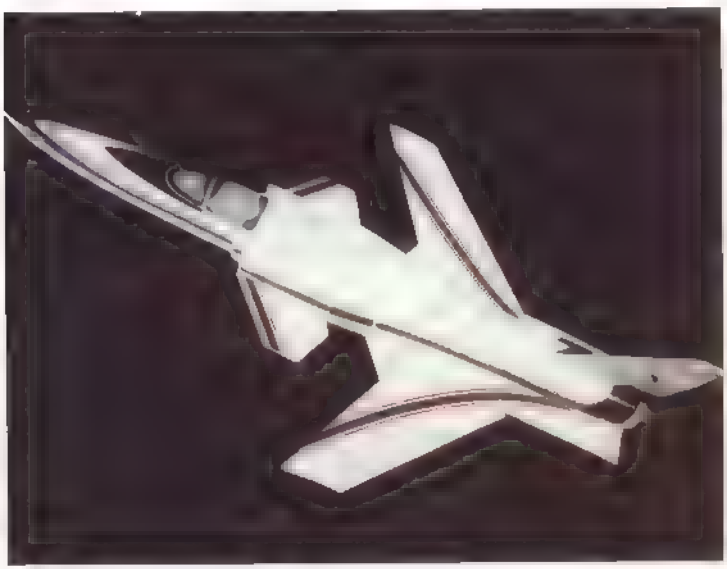
forward wing, the F-16AFTI which can dart up, down or sideways without changing direction, and the Rockwell HiMAT (highly manoeuvrable aircraft technology) which goes for agility at the expense of everything else. Before too long the penny (or rather cent) will drop, and even the USAF will realize that agility gets you nowhere. The things that count are small physical size, RAM (radar-absorbent materials) and the best command of the electromagnetic spectrum.

So, to recap: NATO airpower of the 1990s will have to be as elusive as possible. It certainly cannot be tied to the handful of known airfields or we may as well save our money. It must be widely dispersed in literally thousands of locations, 95 per cent of which at any given moment have nothing there. It must be as nearly as possible invisible to hostile reconnaissance platforms looking down from above. It must also be as invisible as possible, at all EM wavelengths, when it is in flight.

This is a challenge that the 16 nations could work on together, it is too big for any one of them.

Above: Another American idea of how a 1990s fighter might be

Below: In contrast the Grumman X-29A actually exists, though this was drawn before it flew.



Aeritalia/Aermacchi/ EMBRAER AMX

AMX

Origin Joint programme by Aeritalia Combat Aircraft Group, Naples, Italy, Aermacchi SpA, Varese, Italy and EMBRAER SA, [illegible] Campos, Brazil

Type: Single seat attack

Engine [illegible] Rolls-Royce Spey 807 turbofan produced under licence by Alfa Romeo and Piaggio

Dimensions Span (exc AAMs) [illegible] 8.88m); length 44ft 6¼in (13.57m), wing area 226.0sq ft (21.0m²)

Weights [illegible]

Performance [illegible] Mach [illegible] with [illegible] at Mach [illegible]

Armament [illegible] mm M61A1 with [illegible] ammo drum [illegible] 1,000lb (454kg) [illegible] 1,000lb (454kg) [illegible] AIM-9L or similar AAMs [illegible] but for very short range theoretically 8,000lb (3,629kg) plus AAMs

History Project started 1977, first flight [illegible] 1983, deliveries from 1986

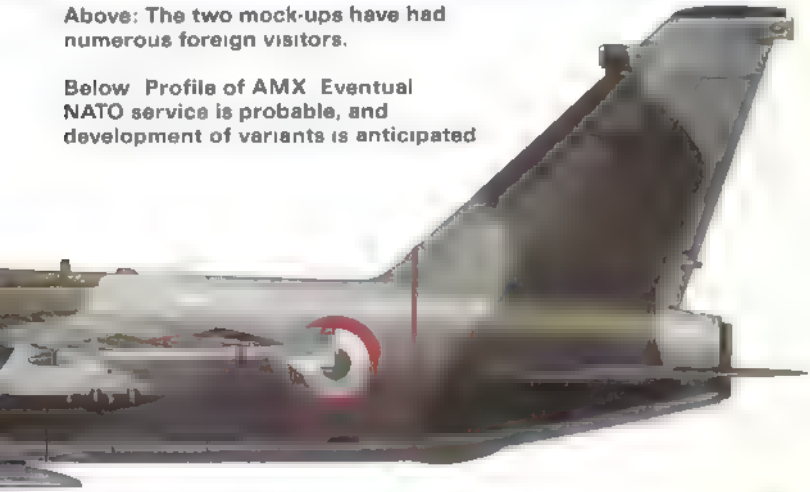
Users Expected to be Italy and Brazil, plus export customers

Deployment Throughout the early 1970s Aeritalia, previously Fiat Aviazione, studied projects which would replace the company's G91 light attack and reconnaissance aircraft. The [illegible] on a new generation aircraft in the same class. This [illegible] looking for a new interceptor and air combat fighter, but the AMX (the designation stemmed from Aeritalia, Aermacchi experimental) [illegible] the second Italian partner [illegible] mid-1978 [illegible] the AMX [illegible] which has an [illegible] requirement for [illegible] 87 for the [illegible] of [illegible] AMX [illegible] to be an extremely [illegible] role aircraft in the class of the Skyhawk. [illegible] as this book went to press, [illegible] passive warning receivers, [illegible] Nordair [illegible] system [illegible] 1987 [illegible]

Above: The latest Aeritalia artwork illustrating AMX when this book went to press in early 1983, it is based on a model photo.

Above: The two mock-ups have had numerous foreign visitors.

Below Profile of AMX Eventual NATO service is probable, and development of variants is anticipated



Aeritalia G91

G91R, G91T, G91PAN and G91Y

Origin: Fiat SpA (now Aeritalia SpA)

Type: G91R and Y single seat tactical reconnaissance/fighter. G91T two seat weapon trainer. G91PAN single seat aerobatic display fighter.

Engines. G91R, T and PAN, one 5,000 lb (2,268kg) thrust Rolls Royce Orpheus 80302 turbojet. (G91Y) two General Electric J85-13A augmented turbojets each rated at 4,080 lb (1,850kg) with full afterburner.

Dimensions: Span: G91R, T, PAN, 28ft 1in (8.57m); G91Y 29ft 6 3/4in (9.01m); length: (G91R, PAN) 33ft 9 1/4in (10.31m); (G91T, Y) 38ft 3 1/4in (11.67m); height: (G91R, PAN) 13ft 1 1/4in (4m); (G91T, Y) 14ft 6in (4.43m); wing area 176.74sq ft (16.42m²).

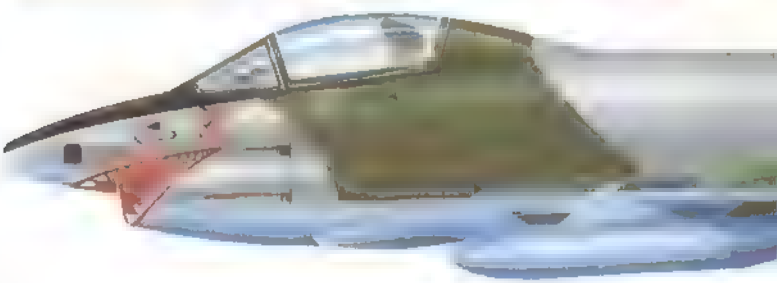
Weights: Empty: (G91R) typical, 7,275 lb (3,300kg); (G91Y) 8,598 lb (3,900kg); maximum loaded: G91R) 12,500 lb (5,695kg); (G91Y) 19,180 lb (8,700kg).

Performance: Maximum speed: (G91R) 675 mph (1,086km/h); (G91Y) 690mph (1,110km/h); initial climb: (G91R) 6,000ft (1,829m)/min; G91Y) 17,000ft (5,180m)/min; service ceiling: (G91R) 43,000ft (13,106m); G91Y) 41,000ft (12,500m); combat radius at sea level: (G91R) 196 miles (315km); (G91Y) 372 miles (600km); ferry range: (G91R) 1,150 miles (1,850km); (G91Y) 2,175 miles (3,500km).

Armament: (G91R) four 0.5in Colt Browning machine guns each with 300 rounds and underwing racks for ordnance load up to 500 lb (227kg); G91R/3) two 30mm DEFA 552 cannon each with 125 rounds and underwing racks for ordnance up to 1,000lb (454kg); G91Y two DEFA 552 underwing load up to 4,000lb (1,814kg).

History: First flight 9 August 1956; (G91R) December 1958; (G91Y) prototype 27 December 1966; (production G91Y) June 1971.

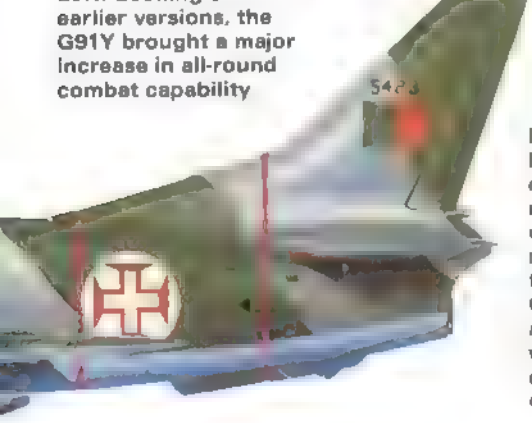
Users. (G91Y) Italy; (earlier versions) Italy, Portuga



Above: Orpheus-powered G91 variants are no longer in front-line service with 32° Stormo, but still fly with other groups.

Deployment: In December 1953 NATO announced a specification for a light tactical strike fighter. It was to be robust, simple to maintain and capable of operation from rough advanced airstrips, yet had to reach Mach 0.92 and be able to deliver conventional or tactical nuclear weapons. Despite arguments from France, the winner was Italy's G91, and Italy deployed 98 G91R-1 and 102 G91T while Germany built 294 under licence and deployed an inventory force of 50 R-3, 50 R/4 and 44 T. These gave good service, and Italy's AMI still flies strike/recon missions with two gruppi (14 and 103) of the 2° Stormo at Treviso San Angelo, as well as the national aerobatic team (313 gruppo) with the PAN version. The Luftwaffe, however, had by late 1982 withdrawn its last G91R, the replacement being the attack version of the Alpha Jet. Almost all the German survivors are now in Portugal, where 42R and 8T equip Esc 301 at BA 6 Montijo. Such is Portugal's shortage of fighters that these have to fulfil the interception task with Sidewinders, as well as their basic attack mission, a task which they are incapable of fulfilling even on a day light Italy went on to build 65 of the more powerful and much more capable G91Y version, and this still equips 101 Gruppo (8° Stormo) and 13 Gruppo (32° Stormo), both at Cervia San Giorgio. Roughly equivalent to a Skyhawk, they will be replaced from 1986 by the new AMX.

Left: Looking similar to earlier versions, the G91Y brought a major increase in all-round combat capability



Left. The air force of Portugal is more critically short of money than any of the others. It has no modern fighter, and these ex-Luftwaffe G91R light attack aircraft are also tasked with the national-defence interception of all intruders!

BAe Buccaneer

Buccaneer S.2B.

Origin Hawker Siddeley Aviation (formerly Blackburn Aircraft, now British Aerospace), UK
Type: Two-seat attack and reconnaissance
Engines: Two 11,030lb (5,003kg) Rolls Royce Spey 101 turbofans
Dimensions: Span 44ft (13.41m), length 63ft 5in (19.33m), height 16ft 3in (4.95m), wing area 514.7sq ft (47.82m²)
Weights. Empty about 30,000lb (13,610kg), maximum loaded 62,000lb (28,123kg)
Performance Maximum speed 690mph (1,110km/h) at sea level, range on typical hi-lo-hi strike mission with weapon load 2,300 miles (3,700km)
Armament Rotating bomb door carries four 1,000lb (454kg) bombs or multi-sensor reconnaissance pack or 440gal tank, four wing pylons each stressed to 3,000lb (1,361kg) compatible with very wide range of guided and/or free fall missiles. Total internal and external stores load 16,000lb (7,257kg)
History: First flight (NA.39) 30 Apr 1958 (production S.1) 23 January 1962, prototype S.2) 17 May 1963 (production S.2) 5 June 1964, final delivery late 1975
Users: UK (RAF)

Deployment After the notorious Defence White Paper of April 1957 which proclaimed manned combat aircraft obsolete, the Blackburn B.103 built to meet the naval attack specification NA.39 was the only new British military aircraft that was not cancelled. Designed for carrier operations ▶

Above right: Firing rockets from an RAF Buccaneer S.2, a first-class aircraft always crippled by lack of proper avionic funds.

Right: 'Bucc' loaded with Paveway smart bomb and one of the ALQ-101 ECM pods bought secondhand at a supposed bargain price.

Below Today Buccaneers wear B-type roundels and have a few equipment updates. Note fox's head badge of No 12 Squadron.

▶wing and tail were dramatically reduced in size as a result of powerful tip-to-tip supercirculation BLC boundary layer control achieved by blasting hot compressed air bled from the engines from narrow slits The S.1 strike Mk 1 was marginal on power but the greatly improved S.2 was a reliable and formidable aircraft The first 84 were ordered by the Royal Navy and most were transferred to RAF Strike Command designated S.2B when converted to launch Martel missiles The RAF signed in 1968 for 43 new S.2Bs with adequate equipment including a refuelling probe which is rarely used in front line service in Germany Within the limits of crapping budgets the RAF Buccaneers have been updated by a few improved avionics and have gradually been recognised as among the world's best long range interception aircraft When carrying a 4 000 lb 1 814kg bomb load a 'Bucc' at full power is faster than a Mirage Phantom or F-16 at low level and burns less fuel per mile Many Red Flag exercises have demonstrated that a well flown example is among the most difficult of all today's aircraft to shoot down On most occasions an intercepting aircraft has failed to get within missile or gun firing parameters before having to abandon the chase because of low fuel state Almost universally the Buccaneer aircrews consider that the only replacement for a Buccaneer in the 1990s will be another Buccaneer with updated avionics

Buccaneers equip 15 and 16 Sqns of RAF Germany 2 ATAF at Laarbruch in the anti-ship and attack role and these are progressively being replaced by Tornado GR 1s in 1983 5 with replacement of Aqua Sabre squadrons as well RAF Germany will in effect gain one extra squadron Tornados will also despite the wishes of their crews soon operate as the present aircraft replace 208 Sqn No 1 Group at Honington The other two UK Buccaneer units 12 and 216 are tasked with maritime patrol and will go on well into the 1990s At they want is better avionics not only internal and a new nav attack system is due in 1984 but also better ECM than the external AN/ALQ 101 pod Their main anti-ship weapon will be Sea Eagle (see companion volume *Airborne Missiles*)

Above RAF training sorties eventually turn out superb tactical attack pilots. Here four aircraft from 208 sqn get under the radar in the UK.

Below: Another aircraft from 208 seen over British terrain of a different nature; it could fly at full power under those electricity grid cables!

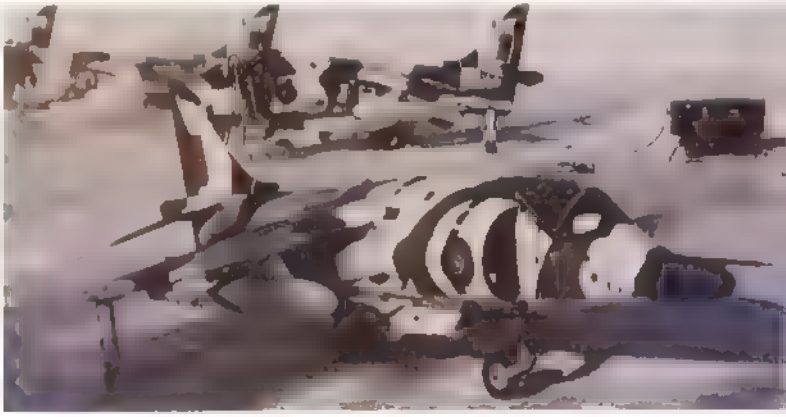
BAe Harrier

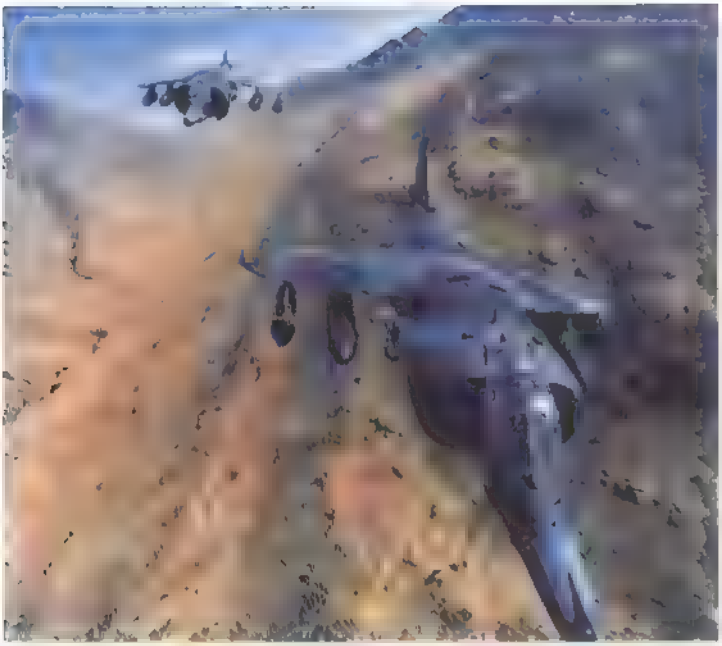
Harrier GR.3 and T.4

Origin. Hawker Siddeley Aviation (now British Aerospace) UK
Type Single-seat STOVL tactical attack and reconnaissance; T.4 dual trainer or special missions
Engine One 21,500lb (9,752kg) thrust Rolls-Royce Pegasus 103 vectored thrust turbofan
Dimensions Span 25ft 3in (7.7m) with bolt-on tips 29ft 8in; length GR.3 47ft 2in (14.38m), T.4 57ft 3in (17.45m); height GR.3 11ft 3in (3.43m), T.4 13ft 8in (4.17m); wing area 201.1sq ft (18.68m²)
Weights Empty GR.3 12,200lb (5,533kg), T.4 13,600lb (6,168kg); maximum (non-VTO/L) 26,000lb (11,793kg)
Performance Maximum speed over 737mph (1,186km/h) Mach 0.972 at low level, maximum level Mach number 1.3 plus; climb VTO/L weight 50,000ft/15,240m in under 3 minutes; service ceiling over 50,000ft (15,240m); take-off/landing strike mission without drop tanks, hi-lo-hi 260 miles (418km), ferry range 2,070 miles (3,300km)
Armament Any external, with many options. Under fuselage strakes each replaceable by pod containing one 30mm Aden gun with 150 rounds. Five or seven stores stations, centre and two inboard each rated at 2,000lb (907kg), outers at 650lb (295kg) and tips if used at 220lb (100kg) for Sidewinder AAMs. First fitted during the Falklands crisis. Normal load 5,300lb (2,400kg) but 8,000lb (3,630kg) has been flown
History First hover P.1127 21 October 1960, development Harrier 31 August 1966, Harrier GR.1 28 December 1967, T.2 24 April 1969, squadron service (GR.1) April 1969. Note GR.1 and T.2 updated to GR.3 and T.4
User: UK (RAF)

Deployment When the experimental P.1127 got daylight under its wheels in 1960 the RAF showed not the slightest interest in any case British combat aircraft were taboo; they had been officially pronounced obsolete. Gradually the RAF did show interest in a much more powerful Mach 2 aircraft, the P.1154, but in 1964 this was cancelled. The Government did however permit the development of a much smaller subsonic aircraft, and this became the Harrier basically a machine of classic simplicity, which pioneered the entire concept of STOVL, short takeoff vertical landing combat operations, and hence aimed mainly at close support and reconnaissance missions from dispersed sites in many parts of Europe.

Though the Harrier's original brief has better range and weapon load than a Hunter, and it has also rather surprisingly emerged as an air combat ▶





Top: A superb action photo of RAF Harrier GR 3s on a typical training sortie over Scotland; bird strike is the main problem.

Above. Harrier GR 3s of No 4 Sqn carry centreline recce pod with five cameras (also here, two tanks and two rocket pods)

Left GR 3s of No 1 Sqn from Wittering sprayed with water-based winter camouflage for NATO Mobile Force exercises in Norway.

▶ adversary of extreme difficulty. Though not designed as a fighter, its combination of small size, unusual shape, lack of visible smoke and unique agility conferred by the ability to vector the engine thrust direction to make impossible square turns, violent deceleration or unexpected vertical movements without change of attitude, make even the original Harrier a most unpopular opponent for any modern interceptor. The RAF Harrier GR.3 has an inertial nav/attack system, laser ranger and marked target seeker and fin-mounted passive warning receivers. It is planned to fit an internal ECM unit by 1985. RAF Germany has two squadrons (3 and 4) at Gütersloh, while 1 (AC) Sqn in 1984 to merge into 1 (G) Operational No. Sqn and 233 OCU, both at Wittering. All these units are vastly experienced. No. 1 Sqn played a central role in the recovery of the Falklands and many RAF Harrier pilots having fought with RN Sea Harrier units. The Harrier has proved a most versatile and useful aircraft. Its shortcomings of limited payload/pylon space being fully rectified in the GR.5 version.

Top right: Rippling rockets at Sardinia from a GR.3 (actually the first production aircraft) from No. 3 Sqn. The SNEB pods were backed up by 2in rockets over Falklands for RN compatibility.

Right: Close-up of the pre-Falklands laser nose of a GR.3 from No. 1 Sqn in Norway, showing crude winter coat which was washed off after return to Wittering. GR.5 pilots will sit higher.

Below: In practice Harriers almost never do a true VTOL. This late 1982 shot shows the wake behind an arrival in wet weather.

BAe Hawk

P.1182 Hawk T.1

Origin: British Aerospace, UK
Type: Two-seat trainer and light interceptor
Engine One 5,340lb (2,422kg) Rolls-Royce/Turbomeca Adour 151 turbofan
Dimensions: Span 30ft 10in (9.4m), length (over probe) 39ft 2¾in (11.95m), height 13ft 5in (4.09m), wing area 179.64sq ft (16.69m²)
Weights empty 7,450lb (3,379kg), loaded (trainer clean) 12,000lb (5,443kg), (attack mission) 16,260lb (7,375kg)
Performance Maximum speed 630mph (1,014km/h) at low level, Mach number 0.8 (slow), 1.1 initial climb 6,000ft (1,830m) min, service ceiling 50,000ft (15,240m), range (on internal fuel) 750 miles (1,207km), endurance with external fuel 3hr
Armament Three (or five hard points, two outboard being optional) each rated at 1,000lb (454kg) (export Hawk 6,800lb/3,085kg) weapon load, centreline point normally equipped with 30mm gun pod and ammunition, intercept role two AIM-9L Sidewinder
History First flight 21 August 1974, service delivery 1976
Users: UK (RAF)

Deployment: The only new all-British military aircraft for 15 years, the Hawk serves as a model of the speed and success that can be achieved when an experienced team is allowed to get on with the job. The RAF ordered 175, all of which were delivered by 1982, equipping No 4 FTS at Valley in the advanced pilot training role (replacing the Gnat and Hunter) and also with No 1 TWU (Tac Weapons Unit) at Brawdy and No 2 TWU at Chivenor in the weapon training role. RAF Hawks normally do not have the outer pylons fitted but these could be added in hours. By late 1982 RAF Hawks had flown 170,000 hours with the lowest accident record for any known military jet in history, (out) defect rates by 70 per cent whilst halving maintenance man-hours per flight hour. Despite the aircraft's greater size and power, fuel burn has been dramatically reduced compared with the Gnat. Hawks also equip the Red Arrows aerobatic display team, again establishing an unprecedented record for trouble-free operation. In the weapon training role aircraft are routinely turned around between sorties in 15 minutes by teams of four armourers. In 1981 it was announced that to back up RAF Strike Command's very limited fighter defence forces, about 30 Hawks would be equipped to fire AIM-9L Sidewinders in the light interception role, under current planning about 72 are actually armed with the missiles. In addition the Hawk was selected in 1981 as the future undergraduate pilot trainer of the US Navy as the T-45A with full carrier gear and the T-45B for naval land training. BAe's marketing the Hawk 100 series as a dedicated multirole attack aircraft with both seats retained and fitted with nav/attack systems related to those of the F-16A.

Above: Rocket practice by a Hawk T.1 of No 1 Tactical Weapons Unit (234 Sqn), RAF Brawdy. The centreline gun pod is not fitted.

Above: Hawk T.1 trainers from RAF No 4 FTS flying over Caernarvon.

Left: Hawks of No 1 TWU are based at Brawdy and bear the insignia of 234 Sqn (seen here) and 79 Sqn. Further Hawks are based at Chivenor with 63 Sqn (2 TWU).

BAe Lightning

Lightning T.5 and F.6 (data for F.6)

Origin English Electric Aviation (now British Aerospace) UK
Type: Single seat all-weather interceptor
Engines Two 15,680lb (7,112kg) thrust Rolls Royce Avon 302 afterburning turbojets
Dimensions Span 34ft 10in (10.6m), length 53ft 3in (16.25m), height 19ft 7in (5.95m), wing area 380.1sq ft (35.31m²)
Weights Empty, about 28,000lb (12,700kg), loaded 50,000lb (22,680kg)
Performance Maximum speed 1,500mph (2,415km/h) at 40,000ft (12,200m), initial climb 50,000ft (15,240m)/min, service ceiling over 60,000ft (18,290m), range with two overwing tanks 800 miles (1,290km)
Armament Interchangeable packs for two all-attitude Red Top or stern-chase Fresh Breeze guided missiles, option of two 30mm Aden cannon in forward part of belly tank, export versions up to 6,000lb (2,722kg) bombs or other offensive stores above and below wings
History First flight (P1B) 4 April 1957, first production F.1 30 October 1959, (first F.6) 17 April 1964
Users: UK (RAF)

Deployment English Electric (later BAC and today BAe's Warton Division) built 338 Lightnings which, despite extreme disinterest by the RAF and political dislike by the Government because it was a manned aircraft, were

event a ya owed to grow n power fue capac ty and weapon capab ty n the RAF however t has always been a pure oca defence nterceptor and even the det t ve F 6 variant has no air ground capab lity ndeed even the overw ng ferry tanks are no onge t tted restr cting the a rc aft to 1 200ga (5 455 tres wh ch would be consumed n six minutes n full afterb rner Primary armament of Red Tops rema ns fa rly effect ve and can be used from any t ng ange inc ud ng head on The two cannon in the front of the be y tank are a good nsta ation caus ng no visib e flash a night and p ots have a ways n erjoye an nfect ve a r gunnery r se a an annua A mament Pract ce amp a Akrot r Cyp us No engage n serv ce with RAF Germany he ghtning rema n an operat ng n erceptor w th Nos 5 and 11 Sqns No 1 Group Str ke Command No 11 Group s due to be merged nto No 1 Group in 1984 The last F 3 s ng e seaters are now stored together w th about 40 Lightnings of various marks wh ch in 1979 82 had been expected to form an add t ona defence squadron The F 6 and a few T 5 two seaters w ll now remain as a a ab e nterceptors un space by the Tornado F 2 in 1984 85

Below: In this profile a Lightning F.6 of No 5 Sqn is depicted with wingless Red Top training missiles.

Foot of page: Lightnings no longer equip 19 Sqn (photo taken over BAe's Warton factory)

BAe Sea Harrier

Sea Harrier FRS.1

Origin: British Aerospace, UK
Type: Multi-role STOVL naval combat aircraft
Engine One 21,500lb (9,752kg) thrust Rolls-Royce Pegasus 104 vectored-thrust turbofan
Dimensions Span 25ft 3in (7.7m), length 47ft 7in (14.5m), height 12ft 2in (3.71m), wing area 201 sq ft (18.68m²)
Weights Empty not disclosed but about 12,250lb (5,557kg), maximum (non-VTOL) probably 25,000lb (11,340kg)
Performance Maximum speed over 737mph (1,186km/h), typical combat speed 690mph (1,110km/h), tactical radius (mission) with full reserves and vertical landing 460 miles (740km), ferry range 2,880 miles (4,630km)
Armament Normally fitted with two 30mm Aden Mk 4 each with 150 rounds. Five hardpoints for max weight load of 8,000lb (3,630kg) including Sea Eagle or Harpoon ASMs, Sidewinder AAMs and very wide range of other stores
History. First flight 20 August 1978, service delivery 18 June 1979, first squadron commissioned 19 September 1979
User: UK (RN)

Deployment Delayed for many years by successive bouts of indecision by the customer, the Sea Harrier at last got the go-ahead in May 1975. Even though even then the idea of seagoing fixed-wing airpower was as taboo as RAF combat aircraft had been at the start of the Harrier programme. Gradually the proposed 'through-deck cruiser' became openly spoken of as a carrier for this STOVL (short takeoff vertical landing) aircraft which was most successfully developed from the Harrier chiefly by redesigning the forward fuselage. The deeper structure provides for a versatile and compact Ferranti Blue Fox radar which folds 180° for shipboard stowage, and a new cockpit with the seat raised to provide space for a much enhanced nav/attack/combat system, and give an all-round view. The Royal Navy purchased 24 plus a further 10 FRS.1s, the designation meaning fighter/recon/strike, strike normally means nuclear, but the Fleet Air Arm has not confirmed this capability. In the NATO context the main task is air defence at all heights, normally with direction from surface vessels, either as DL (deck-launched intercept) or CAP (combat air patrol). In the Falklands fighting in which almost all the RN Sea Harriers (28 out of 32) took part these aircraft repeatedly demonstrated their ability to fly six sorties a day in extremely severe weather with maintenance by torchlight at night often in hail/blizzards. Serviceability was consistently around 95 per cent each morning. CAPs were flown at 10,000ft (3km) at 290mph (463km/h) and with new speeds it was possible to burn-on-an-enemy at 690mph (just above the speed of sound). 24 Argentine aircraft were destroyed by AIM-9L Sidewinders and several by guns, underground missiles as main stores were ▶

Above: A Sea Harrier FRS 1 of No 800 Sqn, with early Sidewinder AIM-9B missiles, photographed with HMS *Hermes* in 1981, after the squadron numbers had been altered to begin with figure 1.

Below: Appearance of one of the first Sea Harriers on the commissioning of No 800 Sqn at HMS *Heron* (RNAS Yeovilton) in April 1980. All markings were oversprayed in April 1982.

▶ 1,000lb (454kg) bombs, Paveway smart bombs and BL.755 clusters. Many new techniques were demonstrated, including 4,000 mile (6,440km) flights to land on ships (sometimes by pilots who had never landed on a ship) and operations from quickly added sheet aid on the top row of containers in a merchant ship.

From this harsh self-sufficient campaign it is a major step to the more sophisticated European environment of greater density and diversity of forces and especially of emitters (though Sea Harriers did use jammer pods in the South Atlantic). The E-2C and other aircraft would normally be available for direction, and the Sea Harrier is envisaged as having the fleet defensive band between ship-to-air missiles and long-range F-14s with Phoenix AAMs. Its ESM fit is more advanced than that of Harriers and is used as a primary aid to intercepting emitting aircraft or the sea-skimming missiles. Pilots normally operate as individuals, flying any mission for which they are qualified. After the Falklands war, 4 additional aircraft were ordered to replace losses from attrition and to increase establishment of the two combat squadrons (800, 801 and 809, normally embarked aboard *Invincible*, *Illustrious* and *Hermes*, later *Ark Royal*), and the training unit 899 Sqn at Yeovilton.

Below: Another April 1980 picture showing the 'peace-time' appearance of the FRS.1 of Lt-Cdr T.J.H. Gedge, first CO of reformed 800 Sqn. It served in the Falklands, the CO then being Lt-Cdr Andrew Auld

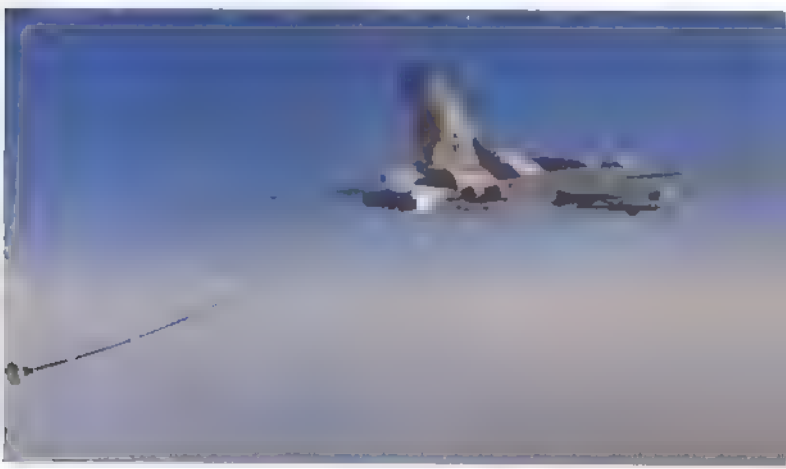
Right. A pre-Falklands vic made up of Sea Harriers from: 899 HQ squadron (leading), 801 Sqn (nearest camera) and 800 Sqn (aircraft 124). A new unit, No 809, was hastily formed and fought from *Hermes*.

BAe Vulcan

Vulcan B.2B, K.2

Origin: A V Roe and Hawker Siddeley Aviation (now BAe Manchester
Type: Long-range bomber (K 2, tanker)
Engines Four 20 000 b (9 072kg, thrust Ro s Royce (Br stol) Olympus 301 turbojets
Dimensions Span 111ft 0 n (33 38m) length (ncluding probe) 105ft 6in (32 16m) he ght 27ft 2 n (8 28m wng area 3 964sq ft 368m²)
Weights Empty about 105 000 b (47 628kg maximum oaded not disclosed but about 250,000lb (113,400kg)
Performance Maximum speed (h gh a t tude 645mph 1 038km/h max cru s ng speed 625mph (1 006km/h) range w th max bomb oad 4,600 m es (7 403km)
Armament: Norma bomb oad 21 standard 1 000lb 454kg) GP bombs prov s on for carrying nuc ear stores no longer used (in the South At antic al Vu cans carried Sidew nder se f defence missiles on underw ng py ons as wel as ECM jammer pods usua y the obso escent Westnghouse ALQ-101 and Shr ke anti-radar miss es)
History: F rst flight 30 August 1952 (prototype B 2) 31 A gust 1957 (product on B 2) 30 August 1958 fina delivery 1964
User: UK (RAF)

Deployment: n 1981 the beaut fully eng neered bat w nged Vu can equ pped No 230 OCU and six squadrons of RAF No 1 Gro up Strike Com mand as we as No 27 Sqn operat ng n the ong range mar t me reconna ssance role w th mult p e sensors and extra fue rep ac ng bombs The former high altitude nuclear bombers wh ch at one t me carried the B ue Steel stand off m ss e and were then expected to carry Skybo t m ssiles on wing py ons, had s nce 1963 operated n the ow-eve

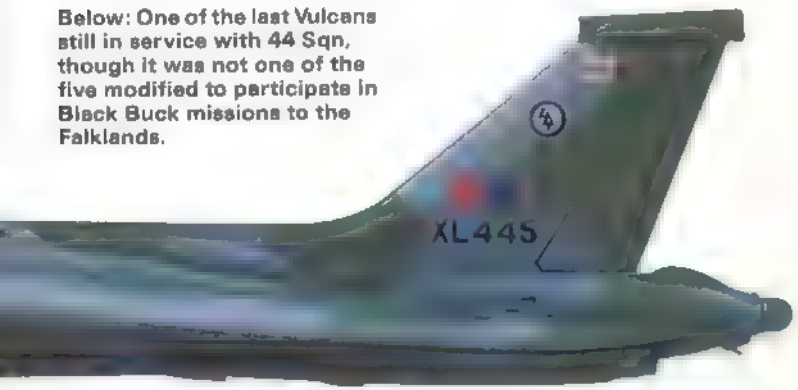


Above. A halcyon study of a B.2 taken in mid-1960s when low-level operations were new (passive warning and TFR are both absent).

conventional role assigned to SACEUR as part of the UK based long range interdiction force. Like the B-52 they relied heavily on advanced defensive as well as offensive avionics to penetrate hostile airspace safely. Squadrons were progressively withdrawn from 1981 pending re-equipment with Tornados and at the start of the Falklands campaign few were left operational in four truncated squadrons. A small number were hastily dispatched to Wideawake (Ascension) from where, with multiple refuellings from Victors, they made the longest combat missions in history, round trips of over 7,960 miles (12 800km) mainly in night attacks on the Stanley runway. On each trip 21 bombs of 1 000 lb were dropped. New probes had to be fitted and the un-maintained flight refuelling systems completely overhauled. Six Vulcans were hastily modified to carry inflight refuelling hosereels in place of ECM gear and these remain in the Strike Command tanker force. Unfortunately the SR.2 aircraft of 27 Sqn have been withdrawn, leaving a gap in NATO's oceanic surveillance. All remaining serviceable Vulcans were expected in late 1982 to be retained combat ready as insurance against further adventures in the South Atlantic.

Left: XM571 was one of the six aircraft modified to serve as an inflight-refuelling tanker, the HDU (hose-drum unit) replacing ECM.

Below: One of the last Vulcans still in service with 44 Sqn, though it was not one of the five modified to participate in Black Buck missions to the Falklands.



Boeing B-52 Stratofortress

B-52D, G and H

Origin. Boeing Airplane Company (from May 1961 The Boeing Company) USA

Type: Heavy bomber and missile platform

Engines D eight 12 100lb (5 489kg) thrust P&WA J57 19W or 29W turbojets G eight 13 750 lb (6 237kg) thrust P&WA J57 43W or 43WB turbojets H eight 17 000lb (7 711kg) thrust P&WA TF33 1 or 3 turbofans

Dimensions: Span 185ft 0in (56 39m) length (D and G/H as built) 157ft 7in (48 0m) G H modified 160ft 11in (49 05m) height (D) 48ft 4in (14 7m) (G H) 40ft 8in (12 4m) wing area 4 000sq ft (371 6m²)

Weights. Empty D about 175 000 lb (79 380kg) (G/H) about 195 000 lb (88 450kg) loaded D about 470 000lb (213 200kg) (G 505 000 lb (229 000kg) H) 505 000 at takeoff (mid flight refuel to 566,000lb (256,738kg)

Performance Maximum speed (true airspeed clean) (D 575mph (925km/h) G H) 595mph (957km h) penetration speed at low altitude at about 405mph (652km h) Mach 0 53 service ceiling D 45 000ft (13 7km) G 46 000ft (14 0km) H 47 000ft (14 3km) range max fuel no external bombs/missiles optimum height cruise D 7 370 miles (11 861km) (G 8 406 miles (13 528km) (H) 10 140 miles (16 303km) takeoff run D 11 100ft (3 383m) G 10 000ft (3 050m) H 9 500ft (2,895m)

Armament: D four 0 5in (12 7mm) guns in occupied tail turret MD 9 system plus 84 bombs of nominal 500lb (227kg) in bomb bay plus 24 of nominal 750lb (340kg) on wing pylons total 60 000 lb (27 215kg) (G four 0 5in (12 7mm) guns in remote control tail turret ASG 15 system plus 8 nuclear bombs or up to 20 SRAM ALCM Harpoon or MRASM or mix eight on internal dispenser plus 12 on wing pylons) H single 20mm six barrel gun in remote control tail turret ASG 21 system plus bombload as G (not yet equipped for ALCM, Harpoon or MRASM)

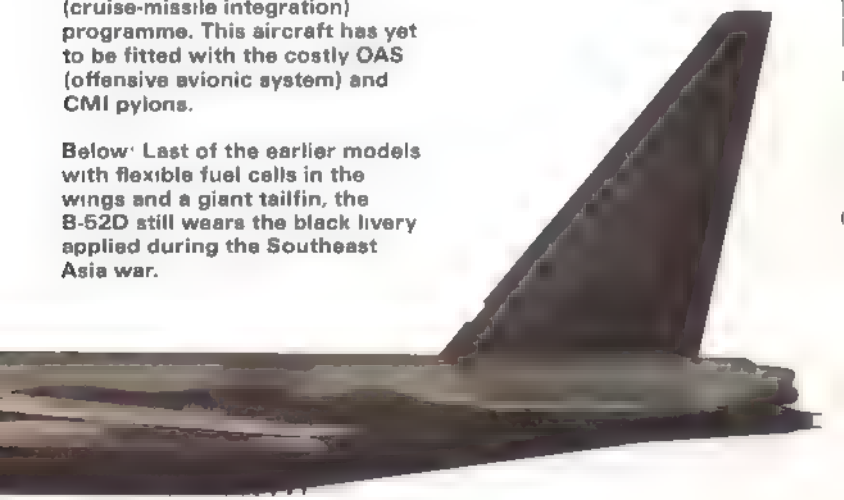
History: First flight 15 April 1952, later, see text

User: USA (Air Force) ▶

Above The first SAC squadron of B-52Gs to become operational with the AGM-86B cruise missile reached initial capability at Griffiss AFB in December 1982 Here the 12 externally carried missiles can be seen on their pylons. Internal carriage is not possible, but the bays are to be rebuilt later in the 1980s

Left: Built in larger numbers (193) than any other version, the B-52G is the lead variant in the CMI (cruise-missile integration) programme. This aircraft has yet to be fitted with the costly OAS (offensive avionic system) and CMI pylons.

Below: Last of the earlier models with flexible fuel cells in the wings and a giant tailfin, the B-52D still wears the black livery applied during the Southeast Asia war.



▶ **Deployment**: The B-52 entered service with USAF Strategic Air Command (SAC) in August 1954 and became operational in June 1955. It was designed to drop small loads of nuclear weapons from the stratosphere, and was designed to extremely close limits in such factors as airframe weight in the expectancy it would be replaced by 1957-60. Today the B-52 is not only still in service but some will have to go on well into the 1990s, and its life is a thousand times tougher, carrying heavy loads of conventional ordnance and stand-off missiles internally and externally with all-penetrations of hostile airspace at low altitude.

To fit them for the ongoing tasks all B-52s currently in the SAC inventory have been the subject of 16 extensive and expensive modification programmes with eight yet to come, to prolong structural life and provide avionics and weapons adequate for the missions. About 80 B-52Gs remain in service, configured to carry large loads of conventional bombs, but the most important variants are the newest. The B-52G: 170 remain of 193 built, it has since 1981 been converted to carry not only the supersonic SRAM (see companion volume *Airborne Missiles*) but also the long-range ALCM cruise missile. SRAM was already carried by the fan-engined B-52H: about 90 remain of 102. B-52s have secondary tasks which include sea surveillance and mine-laying, and in spring 1983 a B-52G was to begin tests with Harpoon anti-ship missiles. In the sea-control mission a missile-armed B-52G could fly 2,000 miles (3,220km) from a coastal base, loiter for 2h and return without refueling. B-52s have even launched tactical weapons such as the GBU-15 smart attack missile and another plan is to carry 12 Assault Breaker anti-armour missiles (using the Patriot SAM airframe) on the wing pylons, together with the associated Pave Mover radar. Yet another weapon is MRASM, in AGM-109H form in the anti-runway mission. Thus the B-52 could play a major role at the tactical level in any future conflict in Europe.

Right: Maintenance on the B-52s (called Buffs, meaning Big Ugly Fat Fellas) is helped by most parts being newer than the B-52.

Below: A surviving B-52D doing free-fall bombing practice on a low-level range (probably at Guam, in the Pacific).

Dassault-Breguet Mirage III and 5

Mirage III and 5

Origin: Avions Marcel Dassault Breguet Aviation France; actual manufacture dispersed throughout French and Belgian industry

Type: Single-seat or two-seat interceptor, tactical strike, trainer or reconnaissance aircraft (depending on sub-type)

Engine: (IIIC) 13,225lb (6,000kg) thrust maximum afterburning SNECMA Atar 9B turbojet; most of the IIIs and some 5s 13,670lb (6,200kg) Atar 9C

Dimensions: Span 27ft 8.2in (8.44m); length exc probe (IIIC) 48ft 5in (14.75m), (IIIE) 49ft 3.4in (15.03m); 5s 51ft 0.4in (15.55m); height 13ft 11½in (4.25m); wing area 375sq ft (35.0m²)

Weights: Empty (IIIC) 13,570lb (6,156kg); (IIIE) 15,540lb (7,050kg); (IIIR) 14,550lb (6,600kg); (IIIB) 13,820lb (6,270kg); 5s 14,550lb (6,600kg); loaded (IIIC) 19,700lb (8,936kg); (IIIE, IIIR, 5s) 29,760lb (13,500kg); (IIIB) 26,455lb (12,000kg)

Performance: Maximum speed all mks except clean 863mph (1,390km/hr) Mach 1.14 at sea level, 1,460mph (2,350km/hr) Mach 2.2 at altitude; initial climb over 6,400ft (1,500m)/min; time to 36,090ft (11,000m) 3 ▶

Above: Though limited in range and mission equipment (both volume and available weight) the Mirage IIIR has for 20 years been the sole tac recon aircraft of the Armée de l'Air. The 33e Escadre is now converting to the Mirage F1 CR

Above: One of the 20 Mirage 5F attack aircraft (originally built and paid for by Israel) which equip EC3/13 Auvergne at Colmar This version has a longer and slimmer nose than the Mirage IIIs

Left: Though amazingly maladjusted to the need, in having very fast takeoff and landing and poor all-weather avionics, the Mirage 5BA, of the FAB (Belgian air force) has long enjoyed some of the best inbuilt ECM of any tactical aircraft in NATO. Loral, the supplier, is likely to equip many F-16s.

▶mm) service ceiling (Mach 1.8) 55,775ft (17,000m), range (clean) at altitude about 1,000 miles (1,610km) combat radius in attack mission with two bombs and tanks (hi-alt tude) 745 miles (1,200km), ferry range with three external tanks, 2,485 miles (4,000km)

Armament: Two 30mm DEFA 5-52 cannon each with 125 rounds (normally fitted to all versions except when IIIC carries rocket boost pack) three 1,000lb (454kg) external pylons for bombs missiles or tanks (Mirage 5 seven external pylons with maximum capacity of 9,260lb (4,200kg)

History. First flight (prototype Mirage I 001) 17 November 1956 production IIC 9 October 1960 (prototype 5) 19 May 1967 Belgian assembled 5BA) May 1970

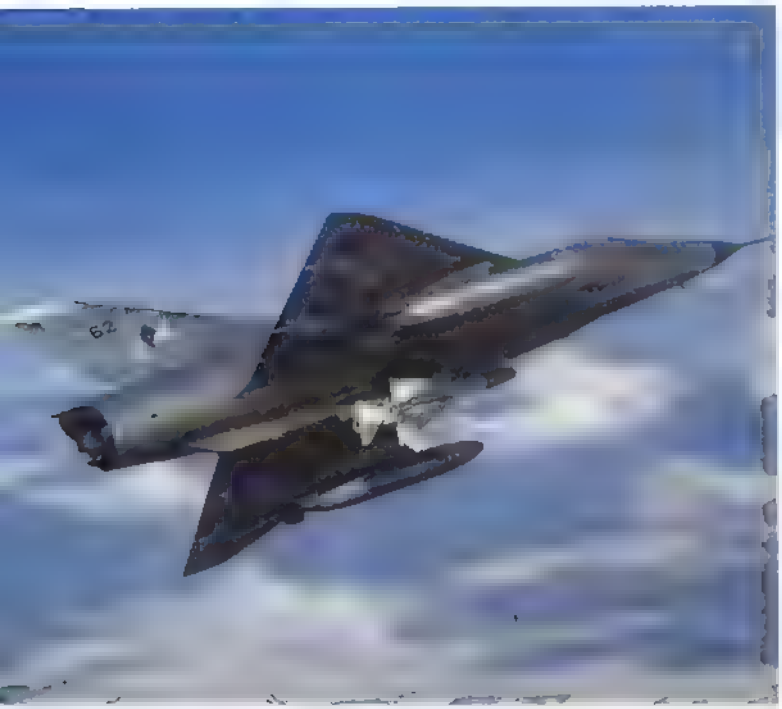
Users: (IIIC) France, Spain, (5) Belgium, France

Deployment. When the French Armée de l'Air adopted the Mirage III in 1957 it bought a world pioneer Mach 2 combat aircraft with quite good interception capability at all altitudes especially at great heights where the optional SEPR guid rocket pack used by French squadrons) gave exceptional speed and agility. Dassault designed the Mirage III to be able to operate from rough front line airstrips but its high landing speed of (minimum 180mph (290km/h) and consequent long field length precludes operation from all except smooth surfaces with a length of some 6,600ft (2km). The Mirage IIIC the first production version is still in

Right: Now at last being replaced by the Mirage 2000, the Armée de l'Air's Mirage IIIC interceptors can be distinguished by twin-eyelid engine nozzle, and the old R 530 missile.

Above: Though fairly simple and cheap, the Mirage 5BA has suffered high attrition with the Force Aérienne Belge, and has never been able to fly the necessary all-weather attack missions.

service with two squadrons of EC 10 at Cre and with EC 2/2 the OCU, but all will have been withdrawn by spring 1983 replacements being the Mirage F1 C and F1 B. Much more important, the IIIE has a longer fuselage and more comprehensive avionics for attack missions. It equips two squadrons of EC2 at Dijon, two squadrons of EC 4 at Luxeuil carrying the AN 52 15 kiloton tactical nuclear bomb and one squadron of EC 13 at Colmar. The other two EC 13 squadrons fly the Mirage 5F a simple attack aircraft which also equips Nos 1 and 2 Sqns of the Belgian AF plus the Belgian Mirage OCU No 8 Sqn. The Mirage IIIR recon aircraft equips the French ER 33 at Strasbourg (from 1983 to convert to the F1 R). Spain's EdA flies the IIIEE in the 11th Ala (wing) Nos 111 and 112 Escuadrons at Manises. These will be the first units to re-equip with the F/A 18A. In a primitive limited war environment the early delta Mirages would be quite effective but they lack the combination of endurance weapon load and avionics needed for the European environment. Belgium's Mirage 5BA does have Lora II internal ECM and a good weapon load but lacks all weather nav/attack systems.



Left: Spain's Ejercito del Aire (air force) is one of the larger users of early delta Mirages, as well as even larger numbers of the F1.C series. This profile illustrates a IIIEE (known as a C-11) which flies with Esc 112 at Manises near Valencia on the east coast of mainland Spain. Their primary role is interception. Replacement is the F/A-18A.

Dassault-Breguet Mirage F1

Mirage F1.C

Origin Avions Marcel Dassault/Breguet Aviation, France, in partnership with Aérospatiale, SABCA, Belgium, and CASA, Spain

Type. Single-seat multi-mission fighter (E), all-weather strike (B), reconnaissance (B), dual trainer

Engine 15,873lb (7,200kg) thrust (maximum afterburner) SNECMA Atar 9K-50 augmented turbojet

Dimensions Span 27ft 6¾in (8.4m), length (F1.C) 49ft 2¾in (15m), (F1.E) 50ft 11in (15.53m), height (F1.C) 14ft 9in (4.5m), (F1.E) 14ft 10½in (4.56m), wing area 269.1sq ft (25.0m²)

Weights Empty (F1.C) 16,314lb (7,400kg), (F1.E) 17,857lb (8,100kg), loaded (clean) (F1.C) 24,030lb (10,900kg), (F1.E) 25,450lb (11,540kg), (maximum) (F1.C) 32,850lb (14,900kg), (F1.E) 33,510lb (15,200kg)

Performance Maximum speed (clean, both versions) 915mph (1,472km/h) (Mach 1.2 at sea level, 1,450mph (2,335km/h), Mach 2.2 at altitude (with modification to cockpit transparency and airframe leading edges, F1.E capable of 2.5), rate of climb (sustained) to Mach 2 at 33,000ft (F1.C) 41,930, 47,835ft, 12,780, 14,580m/min, (F1.E) above 59,000ft (18,000m)/min, service ceiling, (F1.C) 65,600ft (20,000m), (F1.E) 69,750ft (21,250m), range with maximum weapons load, (F1.C) 560 miles (900km), (F1.E) 621 miles (1,000km), ferry range (F1.C) 2,050 miles (3,300km), (F1.E) 2,340 miles (3,765km)

Armament. Both versions, two 30mm DEFA 5.53 cannon each with 135 rounds, five pylons rated at 4,500lb (2,000kg) on centreline, 2,800lb ▶

Above: A Mirage F1.C of the 12 Escadre fully armed with the excellent combination of two Super 530s for long range or interception of very low or very high targets, plus two Magics on the wing tips.

Below: EC 5, normally based at Orange in southern France, is the only operator of the F1.C-200, equipped with a fixed inflight-refuelling probe. Unit is 2/5 'Ile de France'; the store is the finned tank

▶(1 350kg inners and 1 100 lb (500kg) outers launch rails on tips rated at 280 lb (120kg) for air-to-air missiles; total weapon load 8 820 lb (4 000kg). Typical air combat weapons two Matra 550 Magic for close combat one/two Matra Super 530 for long range homing. Optional reconnaissance pod containing cameras SAT Cyclope infrared linescan and EMI side-looking radar

History. First flight (F1 01) 23 December 1966; production F1 C 15 February 1973; (F1 B trainer) 26 May 1976; service delivery (F1 C) 14 March 1973

Users: France, Greece, Spain

Deployment First flown in 1966, the F1 series stemmed from the much larger F2, scaled down to have a single Atar 9 in place of two in earlier Mirages. Though of the most powerful sub-type, the same 9K-50 engine is used in some non-NATO due to Mirages. The F1 has a wing much smaller than the deltas but so much more efficient that the F1 has much shorter field length, slower landing and with 40 per cent greater internal fuel three times the supersonic endurance or twice the actual radius at low levels with superior all-round manoeuvrability. With only single-wheel main gears and a landing speed of 143mph (230km/h) the F1 is also more genuinely able to use short unpaved airstrips. The Armee de l'Air achieved operational capability with the F1 C at Reims 30e Escadre followed by 5e Escadre at Orange (whose three squadrons include 25 of the F1 C-200 type with permanent FR probes to permit non-stop ferry ment to Djibouti 3 100 miles, 5 000km) and similar distant points, and EC 12 at Cambrai. Equipped with Cyrano IV radar and the excellent combination of Magic and Super 530 AAMs, the F1 C is one of the best interceptors in Western Europe. The Armee de l'Air's 225 F1s include 30 F1 R reconnaissance aircraft which from 1983 have been replacing IIIRs with ER 33. Greece uses the F1 CG in 334 Mira at Tanagra in the interception role. Spain's EdA flies 44 F1 CE interceptors with Esc 141 and 142 at Los Llanos and 22 F1 EEs in the strike (non-nuclear) role at Gando, Canaries with Esc 462. The F1 family were in 1983 all fully effective modern aircraft with good all-round capability in all weather. French F1 aircraft can carry the Thomson-CSF Remora self-protection jammer pod and the large Caiman offensive jammer when operating in the dedicated EW role.

Below: Known as the C14 to the Ejercito del Aire (Spanish AF) the Mirage F1.CE is shown in markings of Escuadron 141, at Los Llanos.

Below: Newest fighter of the Elliniki Aeroporia (Greek AF) is the F1 CG seen here in the markings of 114 Wing.

Above: This F1.C of Armée de l'Air EC 1/5 'Vendee' is armed with two old R 530 AAMs far inferior to today's Super 530.

Dassault-Breguet Mirage 2000

Mirage 2000, 2000B and 2000N

Origin: Avions Marcel Dassault/Breguet Aviation, France

Type: Multi-role fighter with emphasis on interception and air superiority combat

Engine: One SNECMA M53-5 afterburning by-pass turbojet, low-ratio turbofan with maximum thrust of 12,350lb (5,602kg) dry and 19,840lb (9,000kg) with afterburner

Dimensions: Span 29ft 6in (9.0m), length 2000 47ft 1in (14.35m), (2000B) 47ft 9in (14.55m), height 17ft 6in (5.3m), wing area 441sq ft (41m²)

Weights: Empty 16,315lb (7,400kg), normal takeoff air intercept mission 33,000lb (14,969kg), maximum 36,375lb (16,500kg)

Performance: Maximum continuous speed at 36,000ft (11,000m) Mach 2.2 (1,320mph (2,124km/h)), maximum attack speed at low level 690mph (1,110km/h), range with two tanks, over 1,118 miles (1,800km)

Armament: Two 30mm DEFA 5.53 cannon, normal air intercept load two Matra Super 530 and two Matra 550 Magic air-to-air missiles, intention is to develop ground-attack version with maximum overload of 13,225lb (6,000kg) of weapons and/or tanks and ECM pods on nine external hardpoints

History: Announcement of project December 1975, first flight 10 March 1978, production delivery, probably mid 1983

User: France ▶

Above: Takeoff at an air display by Mirage 2000 prototype No 04 carrying dummy Magics, a tank and six Matra Beluga bomblet dispensers (seven of the latter can in fact be carried).

Below: The 2000 B01, the first tandem dual trainer prototype, first flew on 11 October 1980. Several production 2000Bs are included in the 73 aircraft ordered for the Armée de l'Air.

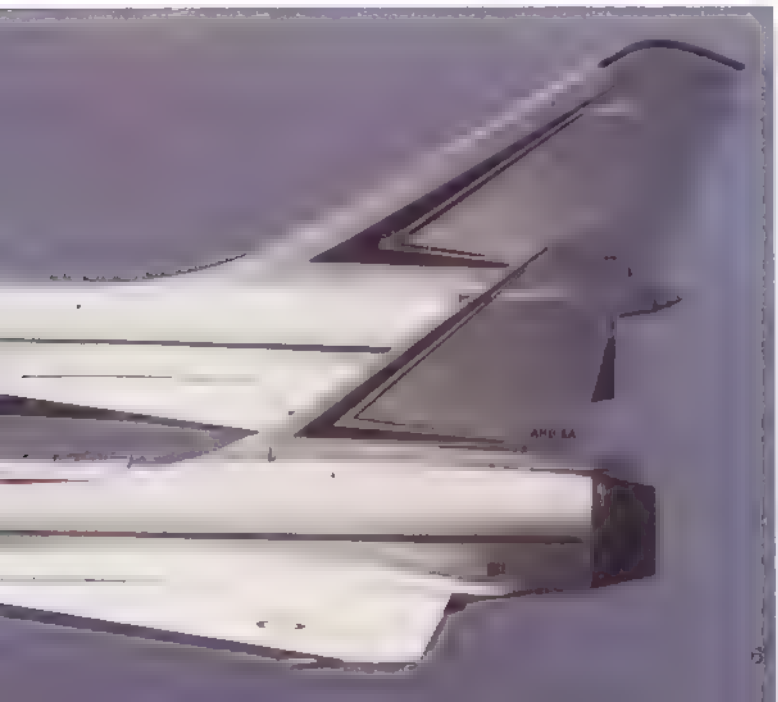
▶**Deployment:** After agonizing periods of indecision this small delta was chosen by Dassault and the Armee de l'Air in December 1975 and the larger twin-engined ACF (Avion de Combat Futur - for which the M53 engine had been designed - was terminated. In most respects the Mirage 2000 is a modern and potentially very agile aircraft, well suited to the air combat role and equipped with an excellent mix of guns, close-range Magic AAMs and medium-range Super 530 AAMs. Structurally, aerodynamically and in its fly-by-wire flight controls providing artificial stability as well as trajectory control, the 2000 is well up to the current state of the art, and its only fundamental difficulty appears to be its price (export customers having quoted various prices in excess of US$38 million). Where the 2000 shows up less well are in the basic questions of propulsion and avionics: the engine being less powerful than the deal, relatively heavy and with a high fuel consumption (except on the very brief occasions when a dash is made at over Mach 2). It is hoped that a more powerful M53-P2 version

Below: A new profile of a production Mirage 2000 for the Armée de l'Air. The markings shown are those of EC 10, which is overdue for replacing its Mirage IIICs used in the interception role from Creil, north of Paris.

Foot of page: Whatever other problems may affect both programmes, the Mirage 2000 and (beyond) the Super Mirage 4000 are aesthetically very attractive aircraft. The first prototypes of each type are here depicted.

w be developed The RDI pu se doppler radar has been de ayed even more than the rest of the aircraft and the earl er RDM or g nally p anned on y for export customers m ust be t tted to a prod ct on aircraft del vered before ate 1985 First deliveries or g na y expected n 1981 will take p ace in 1983 to EC 2 at D on replac ng the Mirage III E n the attack ro e n which the arge wing area gives severe gust response even at he modest 690mph speed) The M rage 2000 can carry a formidab e bombload b t its qua ties t t much better to the nte cept on m ss on n wh ch t is an exce ent aircraft in a tota y d fferent c ass from earl er de ta Mirages The Armee de A r ordered four in 1979 fo owed by three annua ncrements of 22 the ntention being that these wou d operate in the a r c eter ce ro e Dassa t hopes to se t 200 in this role p us as many again for reconnaissance and st ke bo Armee de l A r deci s ons are rov ng very d ff cu t

The M rage 4000 an enlarged de ta with two M53 engines has been produced at company expense t had not fo nd a buyer n ear y 1983



Dassault Mirage IVA

Mirage IVA

Origin: Avions Marcel Dassault (now AMD-BA), France
Type: Supersonic bomber, multisensor reconnaissance and buddy refuelling tanker
Engines: Two 15,432lb (7,000kg) thrust SNECMA Atar 9K afterburning turbojets
Dimensions: Span 38ft 10¾in (11.85m), length 77ft 1in (23.5m), height 17ft 8½in (5.40m), wing area 840sq ft (78.0m²)
Weights: Empty 32,820lb (14,887kg), max t/o 73,800lb (33,475kg)
Performance: Maximum speed (one recessed bomb) 40,000ft (13,12?m) brief dash 1,454mph (2,340km/h), low level penetration speed 690mph (1,110km/h), mission radius (one recessed bomb, two tanks, one unrefuelled supersonic dash) period 770 miles (1,240km)
Armament: One 60kT (tonne) nuclear bomb recessed under fuselage, alternatively up to 16,000lb (7,257kg) of conventional stores on body, wing pylons. Provision for two tanks (one can be a buddy hose/reel pack) and ECM pods, later ASMP see text
History: First flight 17 June 1959, first production aircraft 7 December 1963, final delivery 1967
User: France

Deployment The creation of a French nuclear deterrent (*Force de Dissuasion*) involved silo-based missiles, submarine-based missiles and recallable manned bombers. The bold decision was taken for budgetary reasons to use a supersonic bomber too small to fly typical round-trip missions unaided. Instead the Mirage IVA, tailored around a pair of engines basically similar to those used in Mirage fighters, either takes off with a partner of the same type serving as the tanker to replenish the bomber on its outward journey (the Boeing C-135F is also used for the same purpose)

Below Almost all simulated missions with the Mirage IVA are flown at the lowest possible level, rising to take on fuel

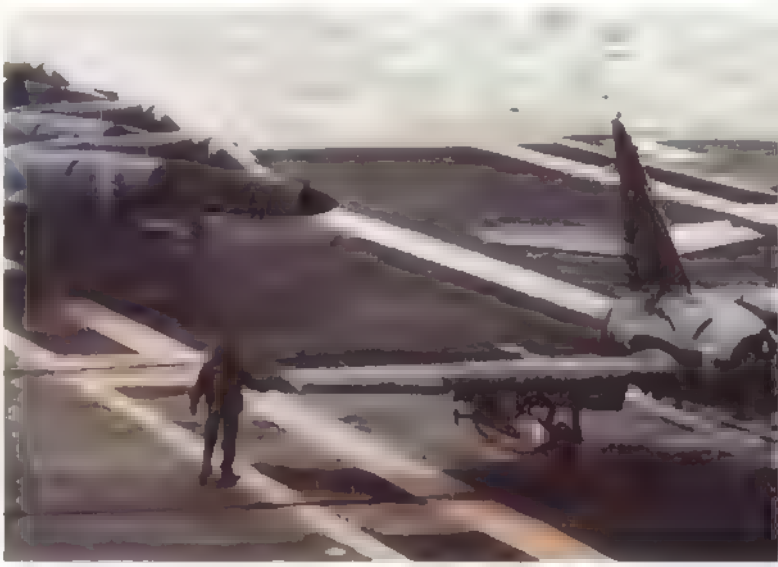
Above It is significant that, while USAF withdrew the much longer-ranged B-58 on cost grounds, Mirage IVAs soldier on

or it recovers to what s hoped to be fr endly or neutra terr tory after dropp ng ts bomb Dassau t built 62 product on aircraft of which 47 a e n the act ve nventory 24 of these be ng at read ness n s x fo r aircraft Escadrons (each Esc norma y compr sing one bomber and one tanker both with C 135F support) The six bases are Mont de Marsan St D zier Cazaux Orange Avord and Luxeu and add tiona dispersa str ps are ava ab e for t me of cr s s A further 12 Mirage VAs are equipped for strateg c reconna ssance t s not known t they can fy this m ss on effect ve y at ow eve ke the bombers From 1986 more kely 1987 the long range ASMP stand off m ssile s expected to be carr ed by the IVA, one under each w ng probab y in addition to tanks

Dassault-Breguet Super Etendard

Super Etendard

Origin Avions Marcel Dassault/Breguet Aviation, France
Type: Single-seat carrier strike fighter
Engine 11,265lb (5,110kg) thrust SNECMA Atar 8K 50 turbojet
Dimensions Span 31ft 5½in (9.6m), length 46ft 11in (14.31m), height 12ft 8in (3.85m), wing area 305.7sq ft (28.4m²)
Weights: Empty 14,220lb (6,450kg), loaded 25,350lb (11,500kg)
Performance Max military speed 745mph (1,200km/h) at sea level, Mach 1 at altitude, initial climb 24,600ft (7,500m)/min, service ceiling 45,000ft (13,700m), radius (hi-lo-hi, one AM.39, one tank) 403 miles (650km)
Armament. Two 30mm DEFA cannon, each with 125 rounds, five pylons for weapon load with fuel, internal fuel of 4,630lb (2,100kg), one AM.39 Exocet can be carried (right wing) with one tank (left)
History First flight (converted Etendard) 28 October 1974, first delivery date 1977
User: France (Aéronavale)



Above: With the abandonment of fixed-wing seagoing airpower by Britain—a decision bitterly regretted in the spring of 1982—France is the only carrier-equipped country in Western Europe, with two (probably nuclear) carriers planned. Aircraft here are Super Etendards (and one Etendard IVM).

Above. The first Dassault-Breguet Super Etendard pictured on flight test. The type entered service with the Aéronavale in June 1978, and all were delivered by the end of 1982. Though classed as a fighter the flight performance is inadequate for success in this role.

Below: Not replaced by the Super Etendard, the Etendard IVP still serves in the photo-reconnaissance role with Flottille 16F at Landivisiau. The belly camera pack may be replaced by a tank or by a 'buddy' inflight-refuelling hosereel pod.

▶ **Deployment** · Dassault originally delivered 69 Etendard IVM carrier based attack aircraft to the French Aeronavale in 1962-64, together with 21 of the IVP photographic reconnaissance version. A naval Jaguar was produced and tested but Dassault managed to get this rejected as an Etendard replacement by its own Super Etendard, with the advantage of some commonality with the earlier machine. Though called a strike fighter the Super Etendard has little air combat capability against enemy high performance aircraft and is used almost wholly in an air-surface role. Equipment includes an Agave multi-mode radar which is fully adequate for most attacks on surface ships, a Sagem (Kearfott licence) inertial navigation/attack system, BF radar warning system and DB 3141 ECM jammer pod. Free-fall bombs of 250 and 400kg sizes can be carried, but the chief anti-ship weapon is the AM 39 Exocet. Super Etendards of the Argentine navy destroyed HMS *Sheffield* and the *Atlantic Conveyor* with AM 38s, though the former ship succumbed to a fire started by the missile's solid-fuel motor, the warhead failing to detonate. The Aeronavale planned to buy 100 Super Etendards but inflation reduced the total to 71 in 1977/82. These equip Flotilles 11F and 14F at Landivisiau, 17F at Hyères and 12F at Lann-Bihoué, the latter in the interception mission replacing the Mach 2 Crusader. The IVP remains in use, but a reconnaissance version of the Super has long been projected. Super Etendard flotilles go to sea aboard the small and aged *Clemenceau* and *Foch*, to replace which two 32 000-tonne nuclear carriers are planned for the end of the century.

Below. Third Super Etendard pictured on carrier trials in the Mediterranean; later trials were in heavy seas in the Atlantic.

Below: Primary anti-ship armament of the Super Etendard is a single AM 39 Exocet, balanced by a tank under the left wing (trials with No 1 prototype).

Above Steam-catapult launch of the eighth Super Etendard, carrying the usual underwing tanks Note the tailplane angle

Dassault-Breguet/Dornier Alpha Jet

Alpha Jet

Origin Jo nt y Dassau t B eg iet France and Dorn er GmbH W Germany with assemb y at each company

Type two seat trainer and ight str ke reconna ssance a rcraft

Engines two 2 976lb (1 350kg thrust SNECMA/Turbomeca Larzac 04 turbofans

Dimensions Span 29ft 10 in (9 11m ength exc ding any probe) 40ft 3½in (12 29m eight 13ft 9in (4 2m wing area 188 4sq ft (17 5m

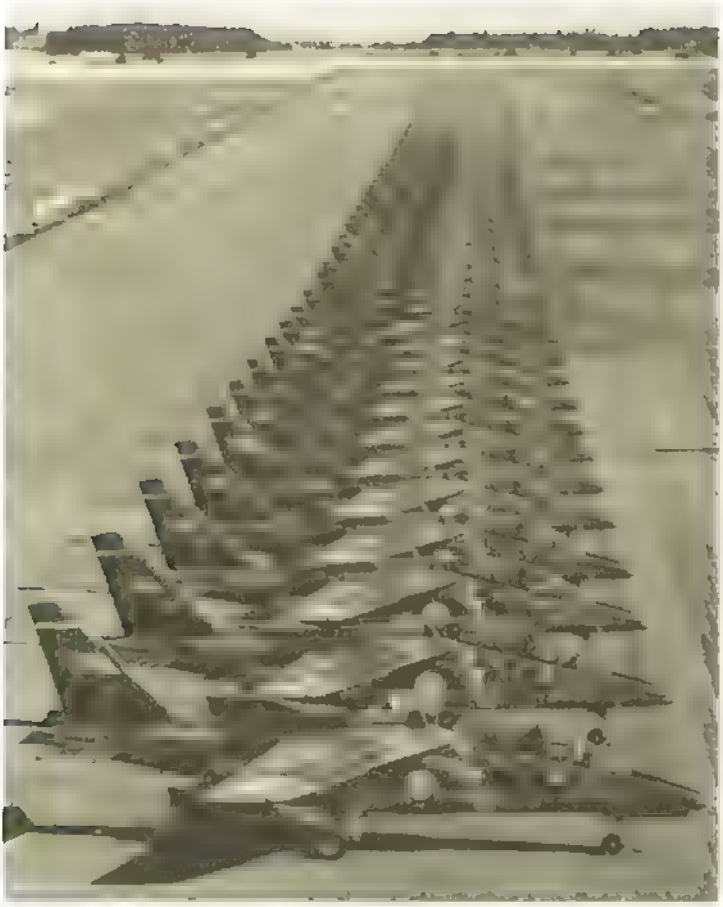
Weights (Trainer) empty 7 374 b 3 345kg oaded ic ean 11 023 b (5,000kg) (max) 16,535lb (7 500kg)

Performance. C ean max mum speed 576mph (927km/hr at sea evel 560mph 900km/h Mach 0 85 at alt tude c mb to 39 370ft 12 000m less han 10 minutes service ce ng 48 000ft 14 630m typica mission end rance 2hr 30min ferry range with two externa tanks 1 827 m es (2,940km)

Armament Opt ona for weapon tra ning o combat miss ons detachable be y tar ng hous ng one 30mm DEFA or 27 mm Mau ser cannon w th 125 rounds same centre ne hardpoint and e ther one or two under each wing (to maximum of five can be prov ded w th pylons for maximum external oad of 5 511lb 2 500kg made up of tanks weapons reconnaissance pod, ECM or other devices

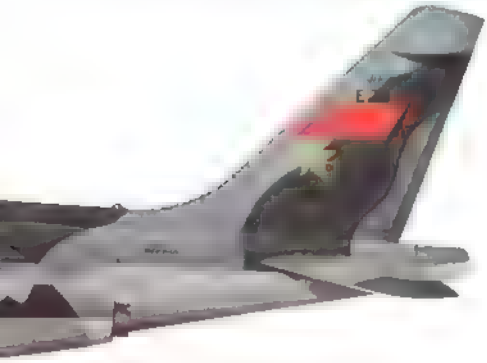
History First flight 26 October 1973 first product on de very ate 1978

Users. Belg um, France, W Germany ▶



Above: Most early deliveries of Alpha Jet trainers (then called the Alpha Jet E) went to the 'Christian Martel' GE 314 wing at Tours St Symphorien, which eventually received more than 60.

Left: Belgian industry shared in manufacture of both the 33 FAB Alpha Jets and their Larzac 04 engines, this was the first.



Left: Almost all the early deliveries to the Armée de l'Air went to GE (Groupement Ecole) 314, named for Christian Martel, at Tours, which received 65. The next 45 when went to EC 8 at Cazaux (replacing Mystére IVs) and the final 65 went to GE 313. Some were sidetracked for the Patrouille de France.

▶ **Deployment.** Realisation that the Jaguar was too capable and costly to be a standard basic trainer led to the Armée de l'Air issuing a requirement for a new trainer in 1967. The chosen design was to be capable of use in the light ground attack role in which the Luftwaffe had a parallel need for an aircraft. On 22 July 1969 the two governments agreed to a common specification and deliveries of the Alpha Jet E. École (school) began in autumn 1978. This model serves with the Armée de l'Air (200 total) to equip the entire Groupement École 314 Christian Martel at Tours, the Patrouille de France aerobatic team at Salon, the Centre d'Entrainement au Vol Sans Visibilité and the 8e Escadre de Transformation at Cazaux. It is also used (33 supplied) by Belgium's 7, 9 and 11 Sqns at St Truiden, St Trond. All these are pure training or display units, but the Federal German Luftwaffe uses a different version in the close-support and reconnaissance roles. The Alpha Jet A (Appui support) has the Mauser gun, a pointed nose with pitot probe, aircraft length 43ft 5in (13.23m) and MBB built Stence seats instead of Martin Baker. A total of 153 was supplied to three fighter/bomber wings: JaboG 49 at Fürstenfeldbruck, JaboG 43 at Oldenburg and JaboG 44 at Husum, each with 51 aircraft on strength. They are austerely equipped for attack missions in the European environment, though navigation systems are good and a HUD (head-up display) is provided. The LaCroix BOZ 10 chaff pod has been developed jointly by France and Germany and is expected to appear with these JaboGs. In the reconnoitre role a Super Cyclope pod can be carried with optical cameras, IR linescan and a decoy launcher. Combat missions are expected to be strongly supported by Awacs (E-3A Sentry) coverage to make up for deficiencies in the Alpha Jet's defensive avionics. The Luftwaffe has 18 Alpha Jets in the weapon training role at Beja, Portugal, the German total being 175.

Right: In many respects the Alpha Jet close-support version (originally called Alpha Jet A) differs from the French type. They are not trainers but are tasked with light attack and reconnaissance

Above: A production trainer of l'Armée de l'Air with gear down and airbrakes open Dassault-Breguet/Dornier have now built single examples of the NGEA attack version and a research machine with supercritical wing

Left: The first prototype, demonstrating its ability to operate from unpaved surfaces. Development ran two years behind schedule.

Fairchild Republic A-10 Thunderbolt II

A-10A, A-10/T, A-10/NAW

Origin: Fairchild Republic Company, USA

Type: Close-support attack aircraft

Engines: Two 9,065lb (4,112kg) thrust General Electric TF34-100 turbofans

Dimensions: Span 57ft 6in (17.53m); length 53ft 4in (16.26m); height (regular) 14ft 8in (4.47m), NAW 15ft 4in (4.67m); wing area 506sq ft (47m²)

Weights: Empty 21,519lb (9,761kg); forward airstrip weight, no fuel but four Mk 82 bombs and 750 rounds 32,730lb (14,846kg); maximum 50,000lb (22,680kg); operating weight empty 24,918lb (11,302kg) (NAW) 28,630lb (12,986kg)

Performance: Maximum speed (max weight A-10A) 423mph (681km/h) (NAW 420mph (676km/h); cruising speed at sea level both 345mph (555km/h); stabilized speed below 8,000ft (2,440m) in 45° dive at weight 35,125lb (15,932kg) 299mph (481km/h); maximum climb at basic design weight of 31,790lb (14,420kg) 6,000ft (1,828m)/min; service ceiling not stated; takeoff run to 50ft (15m) at maximum weight 4,000ft (1,220m); operating radius in CAS mission with 1.8 hours loiter and reserves 288 miles (463km); radius for single deep strike penetration 620 miles (1,000km); ferry range with allowances 2,542 miles (4,091km)

Armament: One GAU-8/A Avenger 30mm seven-barrel gun with 1,174 rounds; total external ordnance load of 16,000lb (7,257kg) hung on 11 pylons, three side-by-side on body and four under each wing; several hundred combinations of stores up to individual weight of 5,000lb (2,268kg) with maximum total weight 14,638lb (6,640kg) with full internal fuel

History: First flight (YA-10A) 10 May 1972; production A-10A, 21 October 1975; (NAW) 4 May 1979 ▶

Above: Formation of A-10As serving with the Connecticut ANG (103 Tac Fighter Group, from Bradley Field).

Below Fairchild have funded this NAW (night and adverse weather) two-seater, which appears much needed.

▶**Deployment**: The concept of a close support aircraft built around a gun of tremendous power for use especially against armour and other hard skinned targets arose from the Co In and light attack studies of the early 1960s. The AX programme was launched in 1967 and Fairchild Republic beat Northrop in the fly off evaluation of the two best designs. From the start the planned force was to be large initially set at 733 aircraft. The whole point of the A-10A was to be its firepower and immediate lethality against ground targets and as far as possible it was made to withstand ground fire up to about 20mm calibre. Systems are duplicated and redundant engines are high at the rear offering minimal infrared signature and the aircraft can fly with one complete engine pod half the tail and various other parts inoperative or shot away and then land without further damage on its retracted wheels. The aeroplane was officially described as austere and though adequate for a sunny day has never sufficed for accurate navigation and weapon delivery in the weather of northern Europe. The Pave Penny laser tracker has been an option from the first aircraft but this merely senses ground targets already illuminated by a friendly laser. To provide proper sensors Fairchild Republic flew a two-seat A-10/NAW night adverse weather prototype with Westinghouse multi-mode radar, Ferranti laser Fir

forward looking infrared and GE low-light TV. It has not been put into production but at least 30 of the 1981 increment of 60 A-10As are of the two-seat A-10, T combat ready trainer variety and these could have night and all-weather sensors if a decision was taken. In any case the Martin Marietta Lantirn low-altitude navigation/targeting FLIR for night ops are expected eventually to be fitted to most A-10As, though cost escalation has placed Lantirn in jeopardy. Late 1982. As this was written, 550 aircraft had been delivered to units of TAC and the ANG as well as to the 81st TFW based at RAF Woodbridge and Bentwaters in England and the 601 TCW at Sembach Germany. Forward operating locations in Germany are routinely used. The A-10A has amply demonstrated good reliability, lethality and the ability to use many weapons, but many have crashed simply by hitting the ground, the aircraft being fully serviceable. To make up for high attrition the total has been increased to 825, but in late 1982 Congress terminated production at close to the original level.

Below: The tail code is difficult to read in this fine portrait but appears to be DM, signifying 355th Tac Fighter Wing from Davis-Monthan AFB. White AGM-65A Mavericks spoil the camouflage.

General Dynamics F-16 Fighting Falcon

F-16A, B, C and D

Origin: General Dynamics, Fort Worth, USA
Type: (A, C) Multi-role fighter; (B, D) operational fighter trainer
Engine: One 23,840lb (10,814kg) thrust Pratt & Whitney F100-200 afterburning turbofan
Dimensions: Span 31ft 0in (9.449m) (32ft 10in (10.1m) over missiles); length (both versions excl probe) 47ft 7in (14.52m); wing area 300.0sq ft (27.87m²)
Weights: Empty: A, 15,137lb (6,866kg); B, 15,778lb (7,157kg); loaded AAMs only: A, 23,357lb (10,594kg); B, 22,814lb (10,348kg); max external load (both) 36,400lb (16,057kg); (Block 25 on) 37,500lb (17,010kg)
Performance: Maximum speed (both AAMs only) 1,350mph (2,173km/h) Mach 2.05 at 40,000ft (12,19km); max cruise at S/L 915mph (1,472km/h) Mach 1.2; initial climb (AAMs only) 50,000ft (15,24km)/min; service ceiling over 50,000ft (15,24km); tactical radius (A, six Mk 82 internal) 340 miles (547km); ferry range 2,415 miles (3,890km)
Armament: One M61A1 20mm gun with 500-515 rounds; centreline pylon for 250gal (1,136l) drop tank or 2,200lb (998kg) bomb; inboard wing pylons for 4,500lb (2,041kg) each; middle wing pylons for 3,500lb (1,587kg) each; outer wing pylons for 700lb (318kg) each, being cleared under MSIP.1 to 3,500lb; wingtip pylons for 425lb (193kg); all ratings being at 9g. Normal maximum load 11,950lb (5,420kg); for 9g 20,450lb (9,276kg) at reduced load factor
History: First flight YF-16, 20 January 1974; production F-16A, 7 August 1978, service delivery (A) 17 August 1978
Users: Belgium, Denmark, Netherlands, Norway, USA (Air Force) ▶

Left: By the time this book appears the USAF may have chosen its advanced attack aircraft. One candidate is the F-16E (F-16XL), the first prototype of which is seen level bombing with 12 x 1,000lb

Above: First meeting in 1979 of F-16Bs assembled in Europe for the four European NATO air force customers front to rear, Denmark, Norway, Belgium and the Netherlands. Norway has tail parachute installation.

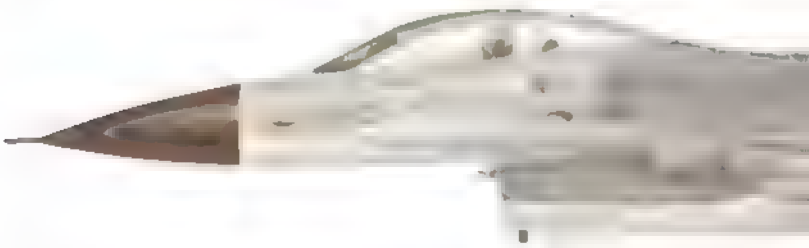
▶ **Deployment** Built as a demonstrator of LWF (Light Weight Fighter) technology in 1974, very much in the face of official disinterest by the USAF (which was totally committed to the F-15 and could see no reason in supporting a supposed interceptor aircraft), the General Dynamics Model 401 was a design of unparalleled performance which offered significant increases in range and agility. Evolution of the aerodynamics and fly-by-wire flight controls was accepted by the USAF as the F-16A (or expectedly, and mainly because it was as well as the F-15 not instead of the USAF bought 650 and then committed itself to 388 not only outstripping the F-15 programme, but representing a growth in real capability despite the ravages of inflation and three-pared budgets. In June 1975 the same aircraft was selected by the four NATO nations mentioned above to replace their F-104 Starfighters and attack types. (Once again, Dynamics not only made the world debut of the F-16A but also gave the RAF its sky blue paint scheme.) Its capability as a fantastic combat fighter, developed with unprecedented accuracy and speed, was partly proved by the early accolades showered on the F-16A detachment deployed to Nellis AFB, Nevada, for the Red Flag exercises in 1981 by the 388th TFW from Hill AFB, Utah. In a total of 80 mock combat missions against the best USAF and USN aircrews, the F-16 unit scored far better than all others against Red Air SAM threats. Its only real problem was in finding good surface-to-air targets and beating all comers in quick turnaround between missions, finally setting the record score of 7,831 points out of 8,000 as the RAF Jaguar unit came second with 6,401. This vividly illustrates the tremendous all-round capability of even the initial F-16A whose tandem dual pilot/weapons officer F-16B has roughly 17 per cent less internal fuel but retains full avionics and weapons capability. ▶

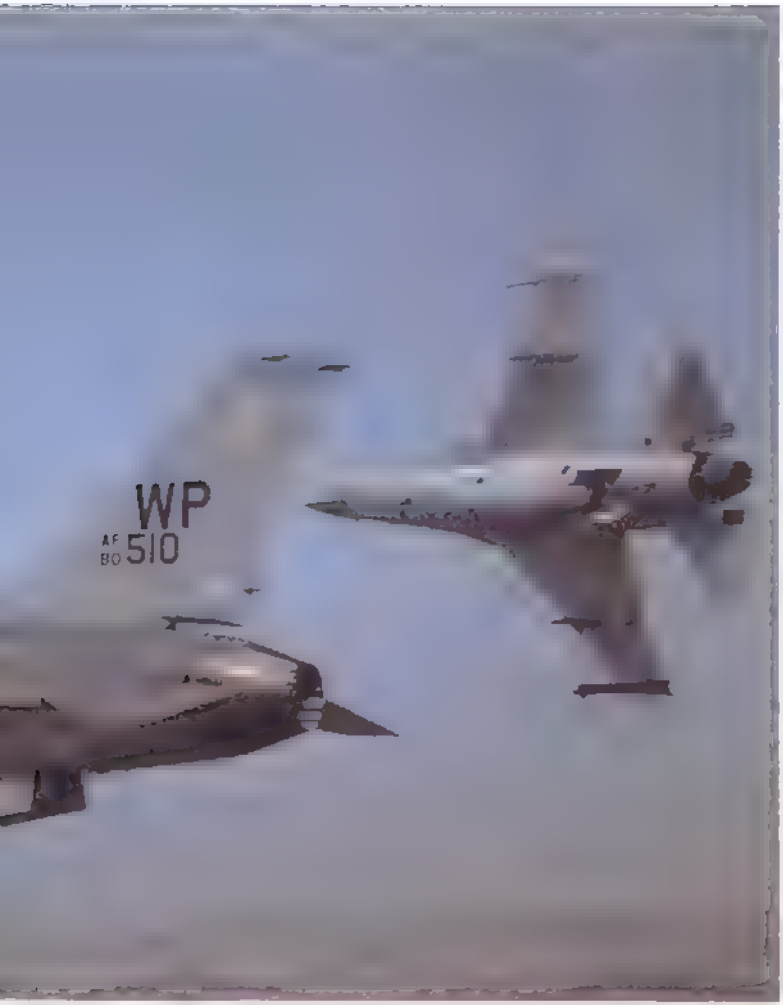
Above: This photo was clearly taken at the same occasion as that on previous page. The two-seater, which accounts for 17 per cent of the buy by these four air forces so far, is a fully combat-ready aircraft with about 17 per cent less internal fuel than the single-seater. A Wild Weasel F-16 would have two seats.

Right: One of the early F-16B two-seaters at the 388th TFW at Hill AFB was painted in Charcoal Lizard camouflage. It was unpopular.

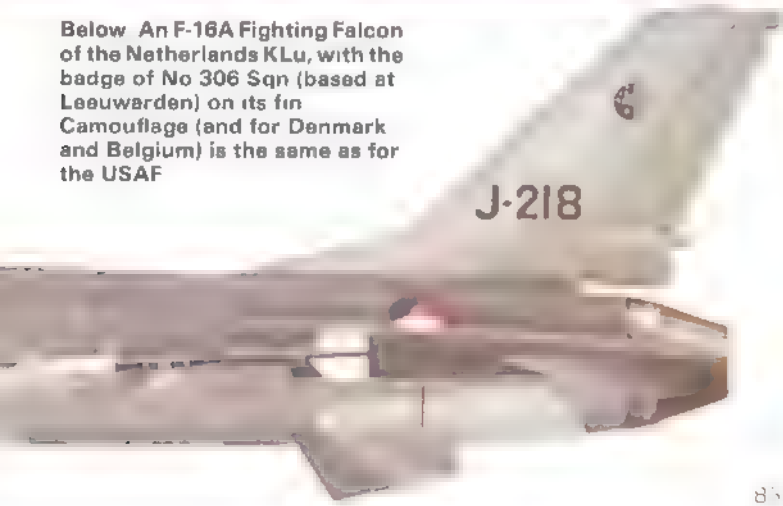
Above Two of the 1978-funded F-16As going round a loop. Virtually every pilot who has flown the F-16 says it is a new and exciting experience.

Above Breaking away from its companion, an F-16A of the 8th Tac Fighter Wing opens its airbrakes between the engine nozzle and the slab tailplanes (which in current production are larger than the tailplanes of these F-16s) The 8th TFW is based at Kunsan AB, South Korea, and the badge on the fin is that of PacAf The famed Wolfpack name is perpetuated by the tail code and the wolf's head on the fuselage.





Below An F-16A Fighting Falcon of the Netherlands KLu, with the badge of No 306 Sqn (based at Leeuwarden) on its fin Camouflage (and for Denmark and Belgium) is the same as for the USAF



▶ When the four European countries selected the F-16 they insisted on substantial industrial offsets and with remarkable speed a multinational manufacturing programme was set up to build production aircraft. A major aircraft, engine, avionics and accessory systems in the four European countries participate and there are assembly lines in Belgium (SABCA), SONACA and the Netherlands (Fokker as well as at Fort Worth). Though this has put up the costs and is not achieving the potential output of which Fort Worth alone would be capable if working at maximum rate, the multinational programme has worked quite well and by late 1982 had delivered over 1,000 aircraft. By far the largest user is the USAF which now has not only the 388th at Hill but also the 56th TFW at MacDill, the 17th at Nellis and the 363rd at Shaw as well as the latest, 81st, at Pope AFB, Kansan AB, South Korea (1982 deliveries even began to Air National Guard units, indicative of the South TFW at Hahn AB (currently being equipped with the 4th ATAF in early 1982. Belgium's FA-16s with No. 349 and 350 Sqns at Beauvechain and Nos 23 and 31 at Kleine Brogel in 1982 (delivery to be completed by 1983) are replacing the Mirage 5BA. Denmark has so far bought 58 (eight single-seat F-16As and 12 being two-seaters). The Netherlands bought an initial 102, has already added the first of a planned annual increment of 22 additional F-16s, the first units to convert being 322 (323 Sqns at Leeuwarden and then 311 (312 at Volkel in 1983/4. No. 306 at Volkel has delayed its reconversion (was to switch to F-16s using the same installations as those the RF-104G). Norway bought an initial 72 painted non-standard uniform dark grey and with an extended tail compartment for a brake parachute. First to convert was 332 Sqn at Rygge followed by 331 at Bodø. 334 was fast converting in 1983 and instead of using Bullpup ASMs in the anti-ship role this unit will arm its F-16s with the indigenous Penguin 3.

Back in the USA a far-reaching MSIP multinational staged improvement programme has led to the future standard aircraft becoming the F-16C single-seat and D two-seat. Larger tailplanes and canopy-mounted sensor pods beside the inlets are the external features but internally the differences are considerable, especially in the digital avionic architecture, the sensors and weapon delivery systems for adverse conditions, and the cockpit displays and Marconi Avionics holographic HUD of unprecedented display size and qualities. General Dynamics has also flown prototypes of a larger tailless cranked arrow F-16, the XL (F-16E) which can outmanoeuvre today's F-16 and carry twice the fuel or bomb load!

Above: Early F-16As from the 388th TFW, USAF, the original recipient, heading out for a practice bombing mission with two sizes of free-fall weapon. Accuracies are phenomenal.

Below: One of the first Dutch single-seaters, carrying only AIM-9J Sidewinder missiles Though the F-16A on p 85 had a 306 Sqn badge, 322 was the first squadron to be equipped.

General Dynamics F-111

F-111A, D, E and F, FB-111A and EF-111A

Origin excep EF General Dynamics Corporation EF Grumman Aerospace Corporation, both USA

Type A D E F all-weather tactical FB strategic bomber EF tactical ECM jammer

Engines Two Pratt & Whitney TF30 afterburning turbofans A E F 18 kN (8 495 kg) TF30-P-3 D 25 kN (11 385 kg) TF30-P-7 FB 20 kN (9 072 kg) TF30-P-12 EF 25 kN (11 385 kg) TF30-P-9

Dimensions Span A D E F 31 ft 11 in (9 73m) 0 21 34m sweep A E F 16° 11 10 34m engines EF 74 ft 0 in (22 6m) wing area (A D,E F EF gross, 16°) 525sq ft (48 77m²)

Weights empty (A 46 2 kg) 22 kg ab 47 21 31 kg 11 kg 22 kg F 47 481 lb 21 kg FB 10 22 kg A 41 50 kg D 92 41 kg EF 0 00 114,300 lb (51 846kg), (EF) 87 478lb (39 680kg)

Performance Max mph 1 320mph 2 1 2km h F Mach 2 5 1 6 3mph 2 660km h F Mach 2 5 1 8 km h 919km h EF 3 592ft 1 950m 60 ft 18 290m EF 54 700ft 16 670m range with max internal A D 3 10 3998km 2 02 4 707km 3 998km (FB) 4,700ft (1 433m), (EF) 3,250ft (991m

Armament internal weapon bay for two B43 bombs or one B43 and one M61 gun three pylons under each wing four inboard swivelling with wing sweep outers beneath fixed and sabre only at 16 otherwise being jettisoned for max external load 31 500 lb 14 288kg FB only provision for two SRAM, two internal (EF) no armament

History First flight 21 December 1964 service delivery A June 1967 (EF) July 1981

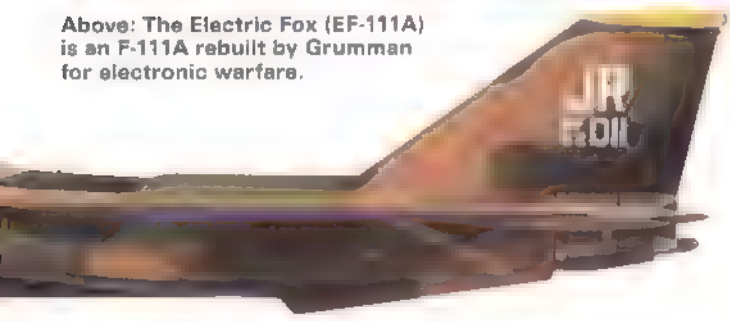
User: USA (Air Force)

Deployment Though it was the centre of the biggest political row ever centred on any aircraft partly because of the unfortunate way it was developed with the Navy partly because many thought the whole programme had been started by the Secretary of Defense, Robert McNamara against the wishes of the uniformed Air Force and partly because of extraordinarily severe technical problems that took years to overcome the F-111 was always destined to be a winner. Its ability to attack targets in the worst weather by day or night over the longest ranges at very low level with pinpoint accuracy, flying through the most hostile defences ▶

Below: All F-111 attack aircraft are similar externally, but their capability varies considerably because of the different avionics and engine installations. This aircraft is an F-111A

Above Most 'Aardvarks' use only the four inboard pylons, and the basic design is such that the body cannot be used except for an ECM pod Here 1,000lb bombs leave an F-111D.

Above: The Electric Fox (EF-111A) is an F-111A rebuilt by Grumman for electronic warfare.



▶and then drop a bomb on it. The basic F-111A version repeatedly demonstrated this capability in Vietnam, making brilliant and very courageous blind low-level attacks using the terrain-following radar coupled to the flight control system, achieving complete surprise over the world's most heavily defended target, Hanoi/Haiphong. The F-111A still equips the 366th TFW at Mountain Home AFB, Idaho, and another USAF-based TFW is the 27th at Cannon AFB, New Mexico, which flies the F-111D with extremely costly and complex digital avionics systems. The FB-111A was developed for Strategic Air Command and the 76 delivered equip two B-52 aircraft wings, the 380th BW at Plattsburgh AFB and the 509th at Pease. These carry SRAM missiles or nuclear bombs, but as they have a capability of 41,250lb (18,711kg) of weapons (8,500lb more than the F-111A), they could also carry a large number of conventional bombs. Most important to NATO are two wings based in the UK, the 20th TFW at Upper Heyford (flies the F-111E) and the 48th at Lakenheath (flies the F-111F with greatly uprated engines and improved avionics and the Terrain Following radar). These were the first wholly all-weather precision attack aircraft in Europe and even today nothing can match their range and payload for a deep attack mission. The ultimate F-111A variant is the rebuilt by General Dynamics of a planned 42 F-111As to serve as sophisticated EW platforms.

Below Badge of the 27th TFW (and TAC badge on the fin) shows this gun-equipped aircraft to be an F-111D (see photo on p.89)

Above Probably taken from a tanker, this photograph shows an F-111 (possibly an F-111A from Nellis) without pylons or tail code

Grumman A-6 Intruder

Grumman A-6E, EA-6A and B, and KA-6D

Origin: Grumman Aerospace, USA

Type: (A-6A, -B, -C, -E) two-seat carrier-based all-weather attack, (EA-6A) two-seat ECM/attack, (A-6B) four-seat ECM, (KA-6D) two-seat air-refuelling tanker

Engines: (EA-6B) two 9,300lb (4,218kg) st Pratt & Whitney J52-P-408, (A-6E) two 11,200lb (5,080kg) st J52-P-8B

Dimensions: (A-6E) span 53 ft 0 in (16.15m), length 54 ft 7 in (16.64m), height 16 ft 2 in (4.93m), (EA-6B) span 53 ft 0 in (16.15m), length 59 ft 3 in (18.1m), height 16 ft 8 in (5.08m), (A-6A, KA-6D) span 53 ft 0 in (16.15m), length 54 ft 7 in (16.64m), height 15 ft 7 in (4.75m), (A-6E, EA-6A) wing area 529 sq ft (49.1m²)

Weights: (A-6A) 27,769lb (12,597kg), (EA-6B) 34,810lb (15,785kg), (A-6E) 27,769lb (12,597kg), max normal loaded (A-6A) 58,600lb (26,580kg), max overload (A-6A) 60,400lb (27,397kg), (EA-6B) 58,500lb (26,535kg)

Performance: Mach number (all A-6s) 0.95, max speed (A-6A) 685mph (1,102km/h) at sea level or 625mph (1,006km/h, Mach 0.94) at height, (EA-6A) over 630mph, (A-6B) 570mph, (A-6E) over 561kt, 648mph (1,043km/h) at sea level, initial climb (A-6E clean) 8,600ft (2,621m)/min, service ceiling (A-6A) 41,660ft (12,700m), (A-6E) 44,600ft (13,595m), (EA-6B) 39,000ft (11,582m), range with full combat load (A-6E) 1,077 miles (1,733km), ferry range with external fuel (all) about 3,100 miles (4,890km)

Armament: All attack versions, including EA-6A, five stores locations each rated at 3,600lb (1,633kg) with maximum total load of 15,000lb (6,804kg), typical load thirty 500lb (227kg) bombs, (EA-6B, KA-6D) none ▶

Above: Despite its very high cost the EA-6B is proving a capable and often essential aircraft in any tactical situation. This example from CVW-17 (here operating from NAS Lemoore) is loaded with two tanks and three self-powered pods each housing two jamming transmitters

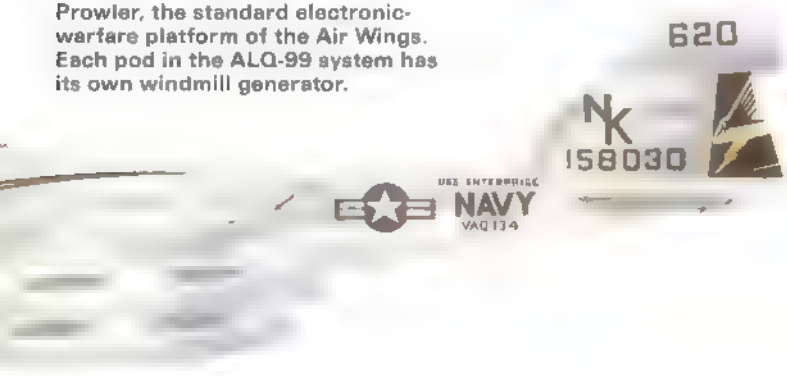
Above Taken during the Vietnam war this photograph shows an A-6A of VA-35 operating from USS *Enterprise* Most Navy attack squadrons have since re-equipped with the updated A-6E

History First flight (YA2F-1) 19 Apr 1960 service acceptance of A-6A February 1963 First flight EA-6A 1963 KA-6D 25 May 1968 EA-6B 25 May 1968 A-6E 27 February 1970 [illegible]

User: USA (Navy, Marine Corps

Deployment With 13 [illegible] carriers now in service the US Navy continues to [illegible] A-6E [illegible] year [illegible] extremely low. By late 1982 [illegible] on the Navy with the A-6E, each [illegible] KA-[illegible] ▶

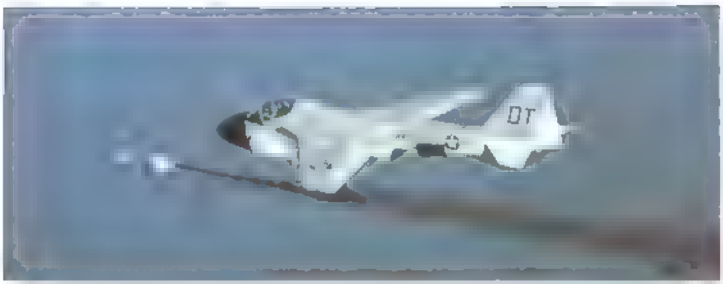
Below: Profile of an EA-6B Prowler, the standard electronic-warfare platform of the Air Wings. Each pod in the ALQ-99 system has its own windmill generator.



▶ two are always ashore at Oceana for the Atlantic Fleet and Whidbey Island for the Pacific and the rest are at sea embarked in one of the monster CVs or CVNs. In the European theatre the US Sixth Fleet is the dominant naval presence and this has as its nucleus one or usually two carriers forming Carrier Group Two. Naples the most likely ships being USS *Independence JFK Forrestal Saratoga America Nimitz* or possibly the new *Carl Vinson*. The Vietnam war abundantly demonstrated the ability of the A-6 (usually in versions cheaper than the E) to navigate and deliver accurately in bad weather or at night and with the support of tankers and the EA-6B to jam ground and airborne radar the Navy's A-6 squadrons represent formidable striking power. The Marines do not normally operate from carriers but any big Atlantic crisis would certainly see some of their five A-6 all weather VMA(AW) attack squadrons committed to NATO's defence. Three Marine electronic warfare squadrons operate 15 EA-6Bs.

Right. These A-6A Intruders have now been converted into KA-6D tankers, and VA-176, though retaining the same tail code as part of CVW-6, flies from USS *America*. In this early version the avionics were voluminous and extensive but crew workload was high.

Below: Experience with this A-6A, an early version of Intruder, was of great value in planning today's A-6E, whose avionics are a generation later and an order of magnitude better. Probes are compatible with RAF tankers.



Above Developed in 1950-56, the AGM-12 Bullpup was the first ASM (air-to-surface missile) to go into service after World War II.

Grumman F-14 Tomcat

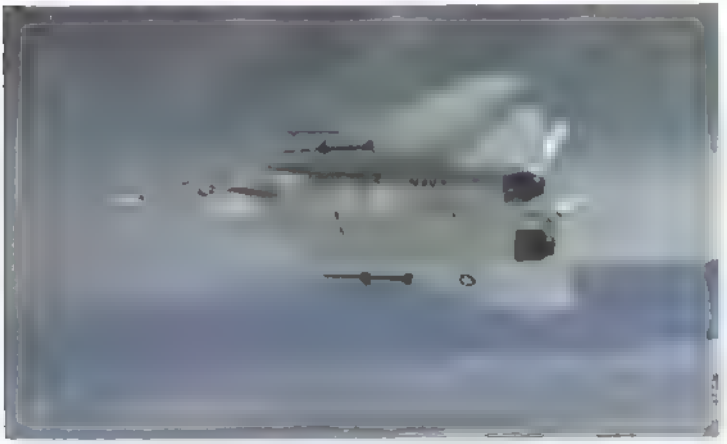
F-14A and C

Origin: Grumman Aerospace USA
Type: Two-seat carrier-based multi role fighter
Engines F 14A wo 20 900lb 180kg th ast Pratt & Whitney TF30 412A afterburn ng sofans C w 20 900 b 9 480kg thrust Pratt & Whitney TF30-414A afterburn ng turbofans
Dimensions Spa 68 wea 38 n 63m 2(wee t,4t 1 54m g h 62 6m 1 n neght tot 4 88 r w ng are (spread) 565sq ft ,52 49m²)
Weights Oku a fighte mss 5)0 ,24,948kg), (max mum) 72,000lb (32,658kg,
Performance M x n sp ed 1 4m 2 s17km n Ma 2 34 at h g 1 s 1 7 m Mac 1 2 s ve a 7 s orm g s we g t ove 3 00f 9 144m min Sp ed 5 0 0ft 7 0 r range e w ex end ta 2 0 m es 3 20 km
Armament Mo1 1 arr am n ta ge A M Sp ar a d AIM S down a ar m ss p x A M 1P a ve A M ma x m m ssa e wea e oad r surface attack role 14,500lb (6,577kg)
History 1 pt ece be 19 70 a de p oyment w th S Navy carriers October 1972, (F-14C) 1983
User: USA (Navy)

Deployment Dev ed o re,are the ons ccess , F 111B the F 14A was the best a d ght a rcraft n the wo d in the ear y 1970s C t sy w e h x d geometry F 15 s pressed nto se as a low eve bomber Str e Eagle the va ab sweep F 14 wh ch s ea y suited to a combat missions because of its swing wings has neve opera ed n the

Below: 'Burners glow brightly as an F-14A in low-visibility camouflage is catapulted from a Navy carrier during NATO exercises off Norway in 1982. Also in the picture are two aircraft about to be shot from the adjacent bow catapult, an A-7E and S-3A. F-14 engine reliability has recently improved.

air/surface role though its potential is very considerable. By 1983 some 450 F-14s had been delivered, all of them (except for a handful on trials programmes) being assigned to one of 19 Navy fighter squadrons (VF) replacing the F-4 and in partnership with the E-2C Hawkeye control aircraft providing a quantum jump in capability. A single E-2C can direct 30 fighters simultaneously and each F-14A can engage six individually selected targets at once over distances exceeding 100 miles (161km). The three basic missions of the F-14 are all forms of CAP (combat air patrol). Forcap is interceptor cover for the task force or friendly fleet. Barcap is barrier air defence against a major oncoming attack, and Tarcap is target cover for friendly attack aircraft in hostile airspace. Naturally the aircraft has four stages of air-to-air weapons: guns, close-range Sidewinders, medium-range Sparrows ▶



Above Carrying tanks, this unusually painted F-14A is loaded with four Phoenix, two Sparrows and two Sidewinders

Below F-14As of VF-32, fighter squadron embarked on *JFK* (which lost a Tomcat overboard off Scotland in 1976 but retrieved it)

▶ (later Amraam) and long-range Phoenix. Recent add-ons include the Northrop TCS TV camera set to provide greatly magnified images of distant targets permitting visual identification and the Tarps tactical recon pod system which fits in the belly tunnel and contains optical cameras and IR linescan. For many years dedicated RF-14 configurations have been studied as RA-5C replacements but none has been ordered and Tarps is a temporary way of filling the gap with 48 F-14s thus equipped. Budget limitations prevented implementation of the 1970 plan for successive improved F-14s but the more serious deficiencies of the F-14A in engine reliability and avionics are rectified in the F-14C which replaced the F-14A in production in 1983. No decision has been taken on the much better and more powerful GE F101 DFE engine flown in the Super Tomcat in 1981.

Above: Launch of an AIM-54 Phoenix missile is not an everyday event, mainly because of extremely high cost. This F-14A serves with VF-24 'Checkertails' from USS *Constellation*

Right: Another F-14A from VF-32 loaded in this case with the maximum of six AIM-54A Phoenix long-range missiles

Below Today virtually all the Tomcats in embarked Air Wings are painted in low-contrast grey This example, from VF-33 is just landing aboard *Independence*.

Lockheed F-104 Starfighter

F-104G, S, CF-104, QF-104, RF and RTF-104, TF-104 (data for F-104G)

Origin Lockheed California Co, USA (CF, Canadair, S Aeritalia

Type (G) multimission strike fighter (CF) strike reconnaissance (TF) dual trainer (QF) drone RPV (F-104S) all weather interceptor (RF and RTF) reconnaissance

Engine One General Electric J79 turbojet with afterburner (G, RF, RTF, CF) 15,800lb (7,167kg), (79-11A, S) 17,900lb (8,120kg) (79-19 or J1Q)

Dimensions Span without tip tanks 21ft 11in (6.68m), length 54ft 9in (16.6m), height 13ft 6in (4.11m), wing area 196 sq ft (18.22m²)

Weights Empty 14,092lb (6,387kg), F-104S 14,900lb (6,760kg), maximum (ACN) 28,779lb (13,054kg), F-104S 31,000lb (14,060kg)

Performance Maximum speed 1,450mph (2,334km/h), Mach 2.2, (F-104S 1,320mph (2,124km/h), Mach 2.0) initial climb 50,000ft (15,250m) per second, service ceiling 58,000ft (17,680m), (zoom ceiling over 90,000ft (27,400m), range with maximum weapons about 300 miles (483km), range with four drop tanks (high altitude subsonic) 1,815 miles (2,920km),

Armament One (two versions) centreline rack rated at 2,000lb (907kg) and two underwing pylons each rated at 1,000lb (454kg) and total for (some versions have reduced load) and one 20mm M61 Vulcan multibarrel gun in fuselage (S, M61 gun), two Sparrow or Aspide and two Sidewinder

History First flight (XF-104) 7 February 1954, F-104A 17 February 1956, (F-104G) 5 October 1960, F-104S 30 December 1968, final delivery from United States 1964, final delivery from Aeritalia F-104S, 1975

Users Belgium, Canada, Denmark, W Germany, Greece, Italy, Netherlands, Norway, Spain, Turkey, USA (ANG)

Deployment Clarence L 'Kelly' Johnson planned the Model 83 after talking with fighter pilots in Korea in 1951. The apparent need was for ▶

Above: With the rather rapid withdrawal of F-104Gs the F-104S is now probably the most important NATO Starfighter variant. The chief user is Italy's AMI, which however still has 28 TF-104G trainers in the 20° Gruppo based at Grosseto.

Left. Greece still uses a few single-and two-seat F-104s as advanced trainers at Araxos, including this Canadair 104G.

Below: More powerful and updated in many other ways, the Aeritalia F-104S has proved a cost/effective investment able to fly interception and low-level attack missions. Aircraft from AMI 4° Stormo.

▶ superior flight performance, even at the expense of reduced equipment and weapons or fuel. The original models carried only an M61 gun and two Sidewinders, but in 1960 the Luftwaffe picked the specially designed F-104G as its chief tactical warplane with tremendously improved penetrative capability, with radar mapping and a nuclear bomb. Other NATO partners followed suit and 1,266 F-104Gs were built in a vast multinational programme centred on Federal Germany. Belgium, Denmark and Italy built 200 CF-104s and 181 two-seat TF-104Gs. From 1965 until 1980 these were the most numerous and to European NATO air forces the most important of all types of combat aircraft. Today, however, the Luftwaffe and Marineflieger are steadily replacing various single- and two-seat variants with the far more capable Tornado, while Belgium, the Netherlands, Denmark and Norway are replacing F-104s with the dramatically superior F-16. Nevertheless, large numbers of slightly worn Starfighters continue to soldier on, not only with the nations listed but also with Greece and Turkey, while in Italy much newer aircraft serve in the interceptor role.

Though the F-104G got a bad name for its apparently high accident record with the Luftwaffe, this was the result of inexperienced flight and ground staff and the use of nearly 1,000 aircraft, and certainly did not reflect a defective weapon system. At the same time the basic aircraft is totally unforgiving, demands a good runway surface, though the lengths seldom critical, ground runs rarely exceed ing 3,000ft (900m) and almost any major inflight emergency results in ejection. The low-attack or recon mission is flown well, the aircraft presenting a very small and usually smokeless target which, in the clean condition and with high fuel consumption can work up to 790kt (910mph, 1,464km/h). Most, however, have no internal EW system and standard Gs have only three pylons; apart from wingtip Sidewinders, so ECM pods sterilize one third of the payload. ▶

Above Here seen in service with the AMI's 23° Gruppo, 5° Stormo, Rimini Miramare, the F-104S has the Autonetics R21G radar optimised for air combat and capable of guiding Sparrow and Aspide.

Left In contrast the Canadian Armed Forces have ignored the air-to-air mission and both equip their CF-104s and plan their training on ground attack mission. This aircraft is rocketing at Cold Lake training base.

Below Once by far the most numerous front-line combat aircraft in Western Europe, the F-104G (and sub-variants) of the Luftwaffe are being replaced by Tornados as are the Marineflieger's whose MFG 2 is now almost converted. Most have gone to other NATO nations.

▶*Such has been the pace of F-16 deliveries that few F-104s will remain* in Belgium, Denmark, the Netherlands or Norway by the time this book appears, and though in 1981 the Luftwaffe still had 330 plus 32 two-seaters, half these will have been withdrawn by late 1983. The Marineflieger's MFG 1 will probably be an all-Tornado unit when this book appears, and the big Luftwaffe training force at Luke AFB is winding down. Canada however must keep its CF-104s until 1985-6 during which period the CF-18 will take over. The CAF 1st CAG at Baden-Soellingen deploys about 70 CF-104s and a few two-seat CF-104Ds in the conventional attack and reconnoitre, with back-up training aircraft at Cold Lake, Alberta. Greece's 335 and 336 squadrons at Araxos will fly F-104Gs and TFs for at least the next five years even if a newer aircraft were to be ordered in 1983. Turkey's 141 and 191 squadrons likewise fly secondhand machines in the

attack role with small prospect of a replacement until after 1986. Turkey also has two squadrons (142 and 181) flying the F-104S interceptor bought new from Aeritalia (40 aircraft). The S was a joint US-Italian creation with airframe, avionics and weapons similar to the F-104G but with a more powerful engine and various other improvements. Italy, the AMI bought 200 of this type plus 30 RF-104G recon platforms and 20 TF trainers. Over 40 have been written off but the S has proved an effective interceptor, used under Nadge control with a gun, Sidewinders and medium-range Sparrow or Aspide AAMs. It equips three groups in this role and a further seven in the strike role.

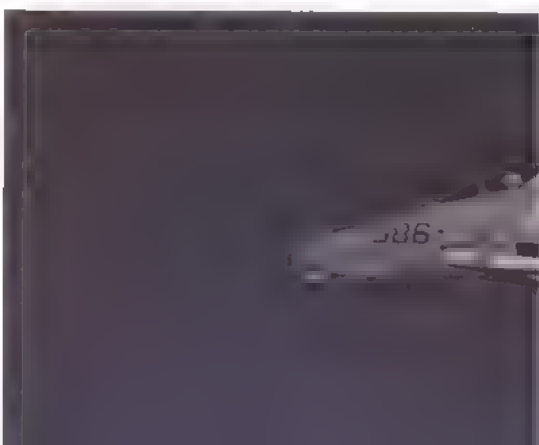
Below: A beautiful picture of F-104S interceptors of the AMI's 5° Stormo 'Giuseppi Cenni' based at Rimini-Miramare. They are carrying maximum fuel but no missiles, an unusual combination.

McDonnell Douglas A-4 Skyhawk

A-4A to A-4Y, OA-4M and TA-4 series

Origin: Douglas Aircraft division of McDonnell Douglas, USA
Type: Single-seat attack bomber (OA two-seat FAC, TA dual-control trainer)
Engine: E, F, 8,500lb (3,856kg) Pratt & Whitney J52-6 turbojet; F, G, H, K, 9,300lb (4,218kg) J52-8A; M, N, Y, 11,200lb (5,080kg) J52-408A
Dimensions: Span 27ft 6in (8.38m); length (E, F, G, H, K, L, P, Q, S) 40ft 1in (12.22m); (M, N, Y) 40ft 3in (12.27m) (OA and TA excluding probe) 42ft 7½in (12.98m); height 15ft 4in (4.57m); (TA series) 15ft 3in
Weights: Empty: E, 10,284lb (typical single-seat eg Y) 10,465lb (4,747kg); TA-4F 10,602 (4,809kg); maximum (catapult, shipboard) 24,500lb (11,113kg); (land-based) 27,420lb (12,437kg)
Performance: Maximum speed (clean): E, 685mph; Y, 670mph (1,078km/h); (TA-4F) 675mph; max. speed (4,000lb/1,814kg bomb load) Y, 645mph; initial climb: Y, 8,440ft (2,572m)/min; service ceiling (clean) about 49,000ft (14,935m); range (clean or with 4,000lb weapons and max. fuel): late versions about 920 miles (1,480km); maximum range (Y) 2,055 miles (3,307km)
Armament: Standard on most versions, two 20mm Mk 12 cannon each with 200 rounds (H, N and optional on other); export versions, two 30mm DEFA 553 each with 150 rounds. Pylons under fuselage and wings for total ordnance load of: E, F, G, H, K, L, P, Q, S, 8,200lb (3,720kg); M, N, Y, 9,155lb (4,153kg).
History: First flight (XA4D-1) 22 June 1954; A-4A 14 August 1954; squadron delivery October 1956; A-4M Apr 1970; (A-4N) June 1972; first of TA series (TA-4E) June 1965; (OA) 1979
User: USA (Marine Corps)

Deployment: One of the world's most cost-effective attack aircraft, the compact, hard-hitting and beautifully engineered Skyhawk was in continuous production for 26 years (1954-79). It has been acquired new and secondhand by air forces and navies all over the world and in Vietnam was used by the US Navy, Marine Corps and Air Force, but it never found its way to any NATO nation outside the USA. Even here it is now used operationally only by the Marines, where it serves in several new-build or remanufactured single-seat attack versions, as well as the OA-4M FAC forward air control mode. The chief operational models are the A-4Y, some of which were the final new-build aircraft while others are rebuilt A-4Ms with the Marconi Avionics HUD, an advanced ARBS (angle-rate bombing system) and other updates including enhanced EW systems. The OA-4M is a rebuild of the

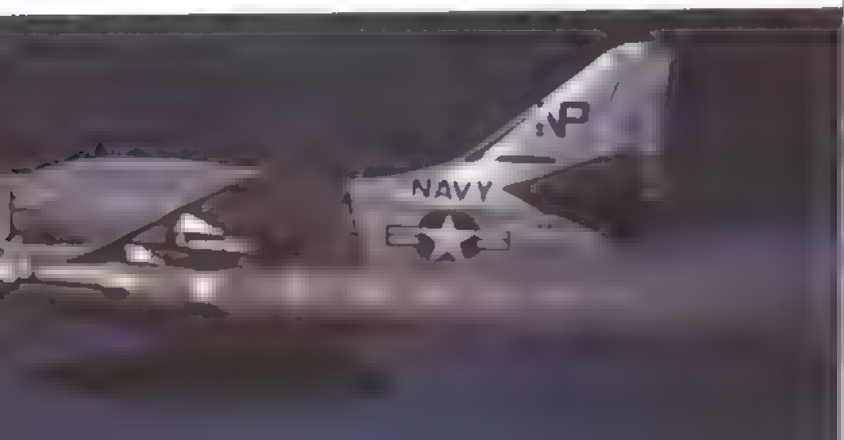


Right: Air-to-air missiles are not normally carried, but this 'Camel' rebuilt A-4C (150586), then with VA-55, is launching an AGM-45 Shrike anti-radar missile, derived from the AIM-7 Sparrow. Tail code NP is no longer used

Above The Skyhawk's tall but narrow landing gear was expected to cause deck stability problems, but did not in use

Below Built as an A4D-2N, this Skyhawk became an A-4C in 1962. It served with VA-83 (later re-equipped with A-7E)

TA-4F trainer 23 having been completely remanufactured by the Naval Air Rework Facility at Pensacola. Any of these could potentially become involved in NATO affairs but in peacetime are likely to be seen in Europe. Most USMC A-4s will be replaced by the AV-8B from 1985



McDonnell Douglas/BAe AV-8 Harrier

AV-8A, TAV-8A, AV-8C, VA-1, VAE-1

Origin British Aerospace UK marketed and supported by McDonnell Aircraft (MCAIR), USA
Type: STOVL fight attack (land or ship based)
Engine One 21 000 lb 9 752kg thrust Rolls-Royce Pegasus 103 Pratt & Whitney F402 402) vectored thrust turbofan
Dimensions Span 25 ft 7 7in 7 70m length 46ft 4in 13 72m two-seat 55ft 9 in 17 00m height 11 4in 3 43m two-seat 13ft 8in 4 17m wing area 201 1sq ft (18 68m²)
Weights. Empty 12 800lb 5 670kg two-seat AV-8B about 13 300lb (6 033kg), maximum 25,000 lb (11,340kg)
Performance Maximum speed at Sea 740mph 191kmh (Mach 0 9) at high altitude Mach 1 3 radius 3/2 2 combat 3 000 to 1 461kg ferry range 58 miles (93km) from VTO 437 miles 703km from 1 200ft 366m run
Armament Additional provision for two 30mm Aden guns with 150 rounds each two Sidewinder AAMs two pylons for weapons 0 to 3 000 lb 361kg on centreline and inboard pylons max weapon load including guns, 5,000lb 2,268kg
History Prototypes as Harrier delivery of first AV-8A 20 November 1970 VA 1) 1976 (AV-8C) 1979
Users: Spain (Navy), USA (Marine Corps)

Deployment. The US Marine Corps found in the original Harrier a totally new kind of weapon which could operate from anywhere a helicopter could go yet provide the performance and firepower of a jet fighter very much against the opposition of the Congressional aerospace lobby and contrary to the professed belief of the Air Force the corps boldly purchased 102 AV-8A Harriers differing from the GR 3 mainly in having a simpler avionic fit with the inertial nav attack system removed and with a modified weapon aiming HUD (wide head up display weapon aiming computer and Sidewinders on outer wing pylons In 1979 84 the 61 surviving AV-8As were being remanufactured at MCAS Cherry Point with support by BAe and MCAIR to emerge as AV-8Cs with improvement devices enhanced avionics and new EW installations The USMC also bought eight two-seat TAV-8As similar to the RAF T 4 The Spanish Navy bought 11 VA 1 Matadors similar to the AV-8A but with Arma avionics radio for use by Escuadron 008 from the ex-*Dedalo* to be replaced by the new *Principe de Asturias* in 1985 6 with Rota as land base as two VAE 1 two-seaters The AV-8s and vAEs have joined others very many of the ex-support fleet from both services to produce types that are already being upgraded by AV-8Bs [illegible]

Below Spain's Arma Aérea de la Armada operates the Harrier as the VA-1 (two-seater is VAE-1) in Esc 008 with home base at Rota The AV-8B is to follow later in the decade

Above: Two US Marine Corps AV-8A Harriers operating from an unprepared site in the mid-1970s. This experience was of value in planning the AV-8C update and all-new AV-8B Harrier II.

McDonnell Douglas/BAe AV-8B Harrier II

AV-8B, Harrier GR.5

Origin McDonnell Aircraft (MCAIR) St Louis with British Aerospace as principal subcontractor

Type STOVL multi-role attack (probably also reconnaissance)

Engine One 21,500lb (9,752kg) thrust Pratt & Whitney F402-404 (RR Pegasus 11-21E) vectored thrust turbofan

Dimensions Span 30ft 4in (9.25m), length 46ft 4in (14.12m), height 11ft 8in (3.56m), wing area 230sq ft (21.37m²)

Weights Empty 12,750lb (5,783kg), maximum (VTO) 19,185lb (8,702kg), (STO) 29,750lb (13,494kg)

Performance Maximum Mach number in level flight 0.91 at sea level, 692mph (1,113km/h), combat radius (STO) seven Mk.82 bombs plus tanks to protect wing, over 748 miles (1,204km), ferry range 2,879 miles (4,633km)

Armament Seven external pylons, centreline rated at 1,000lb (454kg), inboard wing 2,000lb (907kg), centre wing 1,000lb (454kg) and outboard 630lb (286kg), for total external load of 7,000lb (3,175kg) for VTO or 17,000lb (7,711kg) for STO, in addition ventral gun pods for USN one 25mm GAU-12/U gun and ammunition or RAF two 30mm Aden

History First flight YAV-8B (nb plus) 9 November 1978, AV-8B November 1981, entry into service (AV-8B) 1983, (GR.5) 1986

Users AV-8B USA (Marine Corps, possibly also Navy), later Spain (Navy), (GR.5) UK (RAF)

Below: This view shows the new graphite-composite wing of the AV-8B Harrier II, though not LERX root extension. Largest single increment in extra VTO lift was gained by improved circulation round the inner wing with large-chord flaps depressed.

Above Still one of the smallest modern combat aircraft, the AV-8B has by careful detail improvement been made either to carry double the bombload of original Harrier or fly twice the distance.

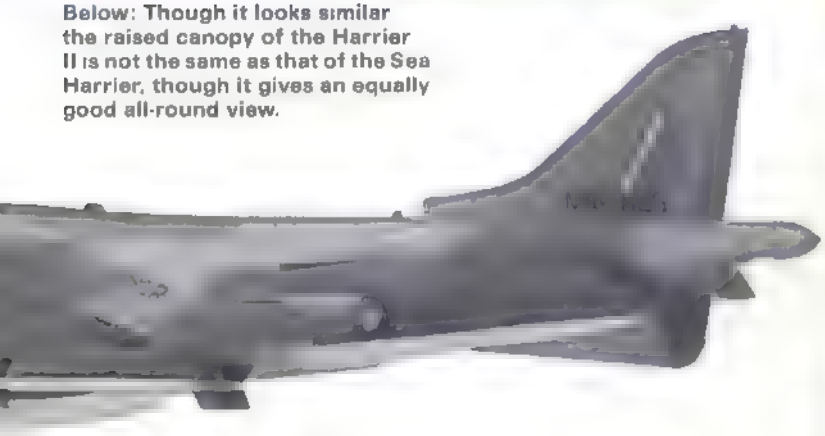
Development Foolishly the UK Defence Minister Roy Mason said in March 1975 that there was not enough common ground to the RAF and US Marine Corps requirements for a second generation Harrier to go ahead as a joint project. The inevitable result was that after more than two years of time wasting the AV-8B was accepted by the RAF in July 1981 in preference to BAe's purpose designed Harrier GR 5, and a collaborative deal was agreed between McDonnell Douglas and BAe. Under its terms the US Marine Corps will receive four FSD full scale development aircraft plus 336 production AV-8B Harriers while the RAF will receive 60 Harrier GR 5s, structurally identical but with different avionics and guns, assembled at Kingston/Dunsfold. The work is split 60 per cent to MCAIR and 40 to BAe, but export sales to third countries are split 75 25, the first of these being Spain which will receive 12 AV-8Bs at a cost of $379 million. Compared with the first generation Harrier the Harrier II has a completely re-engineered airframe with a new graphite composite wing of much greater span, large flaps, improved engine nozzles and jets, and many ▶

▶ other changes which provide 50 per cent more internal fuel and a much greater weapon load: the mission radius or weapon load being approximately doubled with virtually no increase in engine thrust; there is a very small gain in thrust but the Dash 404 engine is aimed chiefly at extending life and reliability and reducing cost. In 1981 the full-scale development programme began with a fatigue and a static test airframe at St Louis, followed by four flight FSD aircraft, all of which are camouflaged and have improved flight augmentation devices and added semicircular LERX (leading-edge root extensions) developed by BAe. The US aircraft have the gun in one ventral pod and the ammunition in the other while the gun pods of the RAF GR.5 are the same as in previous Harriers. Avionics include an

Above: On test near St Louis, the Harrier II is here fitted with the definitive wing with LERX. In January 1983 one of the pre-production machines made the first 'hands off' automatic vertical landing controlled by its new digital autopilot. Advanced cockpit and repositioned reaction-control valves reduce workload.

advanced cockpit display and Smiths HUD ring laser gyro ARBS range rate bombing system and comprehensive passive warning system chaff flare dispenser and centreline ECM pod AN/ALQ-164 in the US Marine Corps the Harrier II will replace remaining A-4 Skyhawks followed by AV-8Cs while in the RAF the GR.5 will replace existing Harriers. The AV-8B is configured very much as a bomber with considerably enhanced weapon load and range compared with existing Harriers and improved avionics. The RAF wanted more weapon capability and thought the GR.5 would have better all round ASW capability as well as a better radius on specified missions. Work continues on developing a supersonic STOVL combat aircraft with a PCB (plenum-chamber burning) engine.

Below: Though it looks similar the raised canopy of the Harrier II is not the same as that of the Sea Harrier, though it gives an equally good all-round view.



McDonnell Douglas F-4 Phantom II

F-4C to S and RF-4

Origin McDonnell Aircraft division of McDonnell Douglas, USA

Type Originally carrier-based all-weather interceptor, now all-weather multi-role fighter, ground-attack and reconnaissance. F-4C to W defence suppression, (RF) all weather multisensor reconnaissance

Engines (C, D, RF) two 17,000lb (7,711kg) General Electric J79-GE-15 turbojets with afterburning; (E, F, G, J, K, M) 20,515lb (9,305kg) Rolls-Royce Spey 202/203 augmented turbofans

Dimensions Span 38ft 5in (11.7m); length (C, D, J, N, S) 58ft 3in (17.76m), (E, F, G and RF versions) 62ft 11in (19.2m); (K, M, S) 57ft 7in (17.55m); height all 16ft 3in (4.96m); wing area 530sq ft (49.2m²)

Weights Empty (C, D, J, N) 28,000lb (12,700kg), (E and RF) 29,000lb (13,150kg), (G, K, M) 31,000lb (14,060kg); max normal loaded (C, D, J, K, M, N, RF) 58,000lb (26,308kg), (E, G) 60,630lb (27,502kg)

Performance Maximum speed with Sparrow missiles only, low 910mph (1,464km/h), Mach 1.19; with 370 engines 920mph with Spey, high 1,500mph (2,414km/h), Mach 2.27; with J79 1,386mph with Spey, initial climb typically 28,000ft (8,534m) min with J79, 32,000ft/min with Spey; service ceiling over 60,000ft (19,685m) with J79, 60,000ft with Spey; range on internal fuel (no weapons) about 1,750 miles (2,817km); ferry range with external fuel typically 2,300 miles, 3,700km (E and variants), 2,600 miles (4,184km)

Armament All versions except RF models which have no armament to a

Above: Spain's Ejercito del Aire uses the F-4CR(S) with the designation C-12. A total of 33 were supplied to equip Esc 121 and Esc 122 both based at Torrejón.

Right: Whereas USAF Phantoms have a boom receptacle those of the US Navy and Marine Corps use the retractable probe, compatible with US or British tankers.

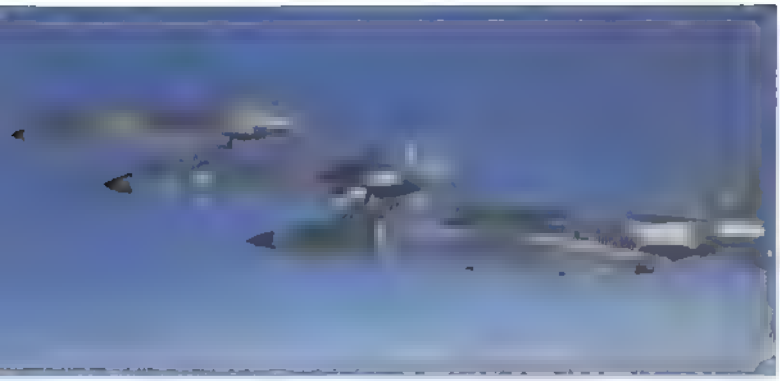
Above. Flightline maintenance for an F-4D's Westinghouse radar

AIM-7 Sparrow or Sky Flash later Amraam air-to-air missiles recessed under fuselage inner wing pylons can carry two more AIM-7 or four AIM-9 Sidewinder missiles In addition E versions except RF have internal 20mm M61 multi-barrel gun and virtually all versions can carry the same gun in external centre-line pod all except RF have centre-line and four wing pylons for tanks bombs or other stores to total weight of 16 000lb (7 257kg)

History: First flight XF4H-1 27 May 1958 service delivery F-4A February 1961 inventory first flight Air Force F-4C 27 May 1963 (F-4E) 30 June 1967 (F-4G) 1976

Users (W Germany Greece Spain Turkey UK RAF USA Air Force ANG Navy Marine Corps)

▶ **Deployment** Undoubtedly the world's No 1 warplane of the 1960s and still one of the most important in the NATO nations, the F-4 was designed as a carrier based naval fighter armed only with AAMs. A proven, supersonic performance, its fitness for such roles as land based interception, long range attack, multi-sensor reconnaissance and service as an advanced EW, electronic warfare, defence suppression aircraft. In its country of origin it has for many years slowly been withdrawn and replaced by the F-14 and F-15, and remaining US Navy F-4s (mostly the F-4J and S variants) are now progressively being replaced by the F/A-18A. Already 1983 however, the F-4 was still extremely important to SAC, equipping the 22nd TFW's Spangdahlem F-4Fs and G-28s at Ramstein F-4Es) to the 36th TFW's (and 401st TFT) various squadrons at Zaragoza, where the F-4Cs and D's of 17 RAF Alconbury and the 26th TRW's Zweibrücken. The F-4G Wild Weasel operated only by the USAF is a specially developed F-4E fighter with the APR-38 EW system whose 52 sensors, mainly in three streamlined large pods facing forwards over the nose and to the rear above the rudder. The system is controlled by a Texas Instruments computer with reprogrammable software to keep up to date with all known threat emitters. This Phantom can carry such weapons as the AGM-65 E-O guided Maverick precision attack weapon, Shrike ARM anti-radar missile and HARM high-speed ARM. Like most of Phantoms, it can fit out Sparrow recessed station pylons an ECM jammer pod, Sidewinder AAMs, heavy fuel other three available for Sparrow AAMs necessary or Sidewinders can be carried under the wings. The F-4G makes a considerable difference to the effectiveness of a strike by friendly aircraft, through detected for they by sensing, locating and destroying many of the most dangerous ground defence systems. Although there is an obvious need for them, curiously no ▶



Top: Taken before the RAF standardized on the B-type roundel, this photo shows an echelon of a USAF F-4E, RAF FGR.2 and Luftwaffe RF-4E.

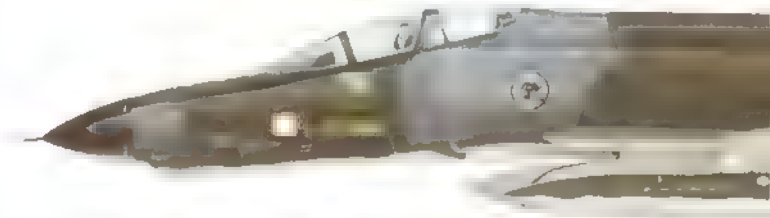
Above: A Westinghouse ALQ-119 (V) ECM pod is in the left front AAM recess of this F-4D-28 formerly used by the 81st TFS at Spangdahlem AB, Germany (today an F-4G operator)

Left This RAF Phantom FGR.2 over Scarborough, Yorkshire, is burdened with seven BL.755 cluster bombs, four Sparrows and two pairs of AIM-9B Sidewinders

Right: A unique type operated by the Luftwaffe is the RF-4E,one of which is seen operating with AG 52 based at Leck. This F-4 variant fits the recon systems of the RF-4C into the uprated airframe of the F-4E. The photo was taken on 16 October 1970 when these F-4s were quite new. The West German Luftwaffe has two Aufklärungsgeschwader (recon wings), each with 30 of these aircraft.

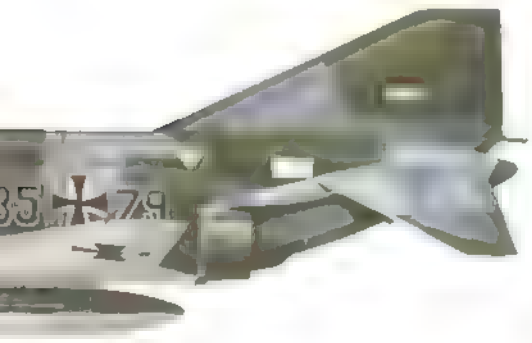
▶ EW conversions have appeared in NATO air forces in Western Europe

Federal Germany's Luftwaffe received 175 F-4F Phantoms which since the mid 1970s have comprised virtually the whole of the key NATO nation's fighter force on the Central Sector. Originally these were simplified F-4Es without many of the USAF avionics and used purely in the interception role equipping JG 71 at Wittmundhafen and JG 74 at Neuburg. Equipped for surface attack the same number (80) equip JaboG 35 at Pferdsfeld and JaboG 36 at Rheine Hopsten. The Luftwaffe also purchased 88 of a unique sub type which was later exported to other customers: the RF-4E the unarmed multi sensor conversion of the F-4E. About 40 equip AG 51 at Bremgarten and another 40 AG 52 at Leck. Since 1980 the Luftwaffe has been trying to get more out of its big Phantom force. The RF-4Es are progressively being reworked by MBB to emerge as dual role recon or attack aircraft (though it is not possible to carry all recon sensors and also deliver bombs on the same mission). The F-4Fs are being upgraded to fire the US Amraam missile. When this is developed this requires substantial changes to the radar and it is expected that new radars will soon be fitted (the APG 65 F/A 18A being suggested). Greece has three 18 strong F-4E squadrons (337 at Larissa and 338 and 339 at Andravida in the attack role. Spain has two 18 aircraft squadrons 121 and 122 of



F 4CRtS based at Torreon in the fighter role plus four RF 4Cs Turkey received 8b F 4Es deployed among 113 Filo at Eskisehir which also has eight RF 4Es 162 at Bandirma and 171 172 at Erhac Malatya all four squadrons are tasked mainly in the strike role

The UK s Phantoms are unlike all other variants in having Spey turbofan engines which give much more thrust at low level and reduced fuel burn in most flight regimes but whose installation caused severe problems and results in high drag which nullifies the extra thrust and even results in sightly poorer maximum speed and turning A total of 52 F 4K were supplied to the RN as Phantom FG 1 and 118 F 4M to the RAF as the FGR 2 Today RAF Germany 2 ATAF has two squadrons of FGR 2s 19 and 92 at Wildenrath while in the UK the same type equips No 23 and 56 at Wattisham 29 and 64 the OCU at Coningsby and 111 and 43 at Leuchars Scotland 43 has the FG 1 some of which are shared A fifty in the interceptor role with Sky Flash AAMs and all-aspect capability though due to be replaced by the Tornado F 2 in the second half of the decade A RAF Phantom have AR 18228 EW warning with the receiver aerials in top fairings ECM pods have been in short supply and the current most widely used AN ALQ 101 but a better pod may one day be found AR 2 1246 1 is for Tornado only



Left A profile of a Luftwaffe RF 4E, again serving with AG 52 from Leck. Though nominal AG strength is 30, in fact each wing has about 40 aircraft with ten in store for attrition. They are being modified to carry out a limited range of attack missions.

McDonnell Douglas F-15 Eagle

F-15A,B,C,D and E

Origin: McDonnell Aircraft Company, USA
Type Air superiority fighter with secondary attack role
Engines Two 23,930lb (10,855kg) thrust Pratt & Whitney F100-00 afterburning turbofans
Dimensions Span 42ft 9¾in (13.05m) length (A) 63ft 9in (19.43m) height 18ft 7in (5.68m) wing area 608sq ft (56.5m²)
Weights Empty equipped 28,000lb (12,700kg) loaded (clean except for missiles) max (clean except for AIM-7) (A) 41,500lb (18,824kg) (C) 44,500lb (20,185kg) maximum with max external load (A) 56,500lb (25,628kg), (C) 68,000lb (30,845kg)
Performance Maximum speed over 36,000ft (10,973m) with no external load except four AIM-7), 1,653mph (2,660km/h) Mach 2.5+ with max external load (rather low, not published) initial climb clean over 50,000ft (15,240m/min, max wt 29,000ft (8,840m) min service ceiling 65,000ft (19,810m) takeoff run (clean) 1,000ft (274m) landing run clean without brake chute 2,500ft (762m) ferry range with three external tanks over 2,878 miles (4,631km) (with CFT tanks also over 3,450 miles (5,560km)
Armament: One 20mm M61A1 gun with 940 rounds, four AIM-7F (later Amraam) fitting against fuselage (four AIM-9L (later Asraam) on tanks at wing pylons, four additional ordnance load 16,000lb (7,257kg) on five stations (two each wing, one centreline)
History First flight (A) 27 July 1972 (B) 7 July 1973 service delivery, Cat I test) March 1974, (inventory) November 1974
User: USA (Air Force) ▶

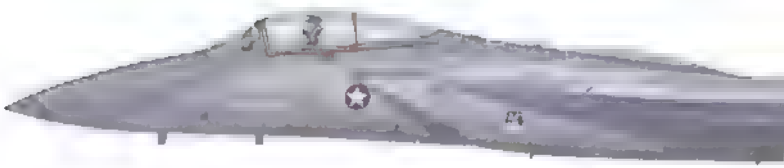
Below: Three F-15As from the 36th TFW (Bitburg AB, West Germany) seen over Norway on exercise Arctic Express '78.

Above Probably the same three aircraft are about to leave Bødo AB, Norway, where they were on detachment from Bitburg

▶ **Deployment** Recognizing its urgent need for a superior long range air combat fighter the Air Force issued an RFP in September 1968 for the FX the McDonnell proposal being selected in late 1969 with the F100 engine and Hughes APG 63 radar following in 1970. Inevitably the demand for long range resulted in a large aircraft the wing having to be so large to meet the manoeuvre requirement that it has a fixed leading edge and plain unblown trailing edge flaps. Two of the extremely powerful engines were needed to achieve the desired ratio of thrust weight which near sea level in the clean condition exceeds unity. The lower edge of the fuselage is tailored to snug fit a pair of four-round range AAMs. The gun is in the bulged strake at the root of the right wing, drawing ammunition from a tank inboard of the cockpit. There is no fuel between the engines owing to adjacent room in the integral tank inner wing and between the ducts for 1 600 lb 5 260kg 448 gal to 592 litre and in the 2 200 gal 2 270 litre drop tanks can be carried each stressed to 5g manoeuvres when fully fuelled by aircraft only at low speeds the rear fuselage and tailplanes taking over control at over Mach 1 together with the twin rudders which are vertical.

Avionics and weapon control systems are typical of the 1970 period with a Hughes X-band pulse-doppler radar vertical situation display presenting ADI attitude director indicator and radar and EO information on one of three CRTs HUD INS and central digital computer for its integral ECM EW subsystems the F-15 was far better than most Western fighters with Loral radar warning with front and rear aspect tail tip Northrop ALQ 135 internal countermeasures system Magnavox EW warning set and Hazeltine APX 76 IFF with automatic replay evaluator. High power jammers however must still be hung externally Westinghouse ▶

Below From the mid-1980s the medium-range missile carried by F-15s will be the new Amraam, one of which is here seen on an early compatibility firing test Later the advanced Sidewinder models will also be replaced, probably by a European Asraam



Above An F-15C used for missile firing tests seen in clean condition apart from centreline tank and red instrumentation link.

Above: Eagles from the 33rd TFW, Eglin AFB, with Canadian CF-104 on Exercise Reforger '82

Left An early production F-15A in service with the 58th Tac Fighter Wing based at Luke AFB, Arizona. This wing is comprised of the 461st, 550th and 551st Tac Fighter Sqns, with weapons training performed at Nellis AFB by the 57th Tac Trg Wing.

▶ pods normally occupying an outer wing pylon. The APG-63 offered excellent capability to track low-level targets with cockpit switches giving a Hotas (Hands on throttle and stick) capability which dramatically improved dogfight performance. Though it was and remains concerned at the price the Air Force got in the F-15A everything it was looking for and in many respects the F-15 has from its entry to service generally been regarded as the world's No 1 fighter (as was the F-4 before it).

USAF procurement is now steadily beyond the original planned force level of 729 partly to replace the F-106 in Strategic Air Command and partly for fresh missions with the Tactical Air Command. Latest versions are the weather strike F-15E derived from the company-funded Strike Eagle. Current production is centred on the F-15C and two-seat F-15D. These would subsequently be capable of Automatic Target Handoff (ATH) in which a ground processor gives the ability to switch the radar target lock-on to a different aircraft in less than a second. Thus a pilot can switch between air and ground targets and keep several firing passes ready locked-on to enemy targets. Extension of the radar's range from 24 to 30km gives a new high-resolution ratio mode which can map the ground from a large distance at extreme range. The costs for Sky Eagle and the USAF's wild cat Amram have been developed. Internal fuel is increased by 2,000 lb (907kg) and conformal fuel tanks (CFTs) are added. Sparrow, Side Arm, Sidewinder, Tactical Electronic Warfare System and the Joint Tactical Information Distribution System are to be integrated. Take-off weight is increased to not less than 9,750 lb (4,422kg).

Almost all the major F-15 Eagles had been delivered by the time this book appeared. European units began with the 57th TTW at Nellis and followed with the 58th TTW at Luke, 1st TFW at Langley the preeminent fire brigade outfit experienced in rapid overseas deployment, 49th TFW at Holloman, 33rd TFW at Eglin and 18th TFW at Okinawa, followed by former F-106 units starting with the 48th FIS. In USAFE the F-15 equips the 36th TFW at Bitburg and the 32nd TFS at Camp Amsterdam, Soesterberg, Netherlands. Existing USAFE F-4 units will convert to the F-15 in the course of 1983-5. Several NATO nations have eyed the F-15 but price and operating costs put it out of reach.

Above. Four single-seaters (probably F-15Cs) from 1st TFW, Langley AFB, Virginia, part of the Rapid Deployment Force

Below. Wide-angle photo taken by the backseater in F 15B of 49th TFW from Holloman showing hook-up to a KC-10A Extender.

McDonnell Douglas/Northrop F/A-18 Hornet

F/A-18A, TF/A-18A, CF-18.

Origin McDonnell Douglas Corp, USA with Northrop building centre and aft fuselage

Type F/A, single seat carrier based multirole fighter, TF, dual trainer, (CF) single seat land-based attack fighter

Engines. Two 16,000lb (7,257kg) thrust General Electric F404-400 augmented turbofans

Dimensions Span with missiles 40ft 4½in (12.31m), without missiles 37ft 6½in (11.43m), length 56ft 1.7in (17.07m), height 15ft 3in (4.66m), wing area 400sq ft (37.16m²)

Weights Provisional, empty 20,583lb (9,336kg), loaded clean 33,642lb (15,260kg), combat attack mission 47,000lb (21,319kg), maximum loaded take-off limit 50,064lb (22,710kg)

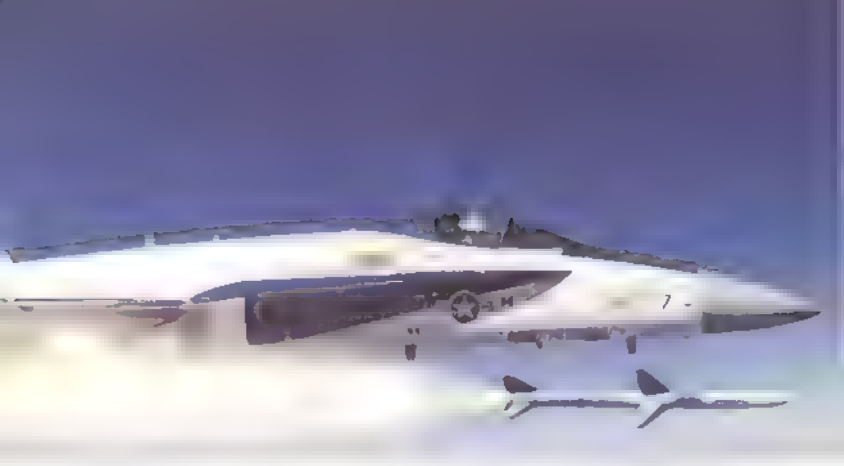
Performance Maximum speed clean at altitude 1,190mph (1,915km/h), Mach 1.8, maximum weight sea level subsonic sustained combat manoeuvre ceiling over 49,000ft (14,935m), combat radius (air to air mission, high, no external fuel) 461 miles (741km), ferry range more than 2,300 miles (3,700km)

Armament One 20mm M61 Gatling in upper part of forward fuselage, nine external weapon stations for maximum load catapult launch of 51,400lb (6,080kg), or rapid takeoff of 17,000lb (7,711kg) including bombs, sensor pods, ECM, missiles including Sparrow and other stores with tip mounted Sidewinders

History First flight (YF-17) 9 June 1974, (first of 11 test F-18) 18 November 1978, (production F/A-18) 1980, service entry, 1982

Users: Canada, Spain, USA (Navy, Marine Corps)

Deployment: Developed by McDonnell aircraft with Northrop collaboration from the latter company's land based YF-17, the F/A-18A Hornet has had a development process that at times has teetered on the brink of collapse. Intended as a cheap lightweight alternative to the F-14 Tomcat it predictably matured as an even more costly aircraft. In 1982 the US Navy



Above The one significant advantage of F/A-18A over F-16 is ability to fire the Sparrow radar-guided medium-range AAM

Secretary said the unit cost ($24 1m at 1981 prices) was too expensive and threatened to cancel at the 240th aircraft at the end of Fiscal Year 1983. Despite this, the F/A-18 has finally emerged as an aircraft of very useful capability and versatility which, because of its deliberate design to fly both fighter and attack missions with equal effectiveness has won two hard fought procurement battles in Canada and Spain. Though the US Navy calculates it would be cheaper to build more F-14s and A-6s – in other words to replace them by the original types – this would appear a retrograde move and there is no way such nations as Canada and Spain would consider following suit.

Of course the F/A-18A is wholly modern in aerodynamics, structure ▶

Below left: The third development Hornet pictured over a Navy carrier (apparently CVA-68 *Nimitz*) over the Pacific in 1981

Below Another view of No 3 prototype, during early carrier trials. In both pictures it has the dogtooth leading edge

▶ systems, avionics and propulsion, the only old part being the weapons such as the M61, Sparrow and basic Sidewinder. Though not a large aircraft, with dimensions between those of the compact Tornado and the F-4, and significantly smaller than the F-15, the F/A-18 combines the Tornado's advantages of small afterburning engines and large internal fuel capacity with avionics and weapons configured from the start for both F and A missions [illegible] designation. Of course in the low-level attack role [illegible] Tornado because [illegible] large wide-span fixed wing [illegible] speed [illegible] Navy Marines [illegible] over the sea and [illegible] target [illegible] [illegible] that the wing has [illegible] AAMs [illegible] AIM-7M [illegible] AAM [illegible] part in the [illegible] CAC [illegible] F-15 [illegible] from 1983 these are [illegible]

replace the Voodoo in squadrons 409, 410, 416 and 425 at Comox BC, Bagotville Que and Chatham NB. Only later will the CF-18 replace the CF-104 in No 1 CAG at Baden-Soellingen, Germany. Spain's procurement was announced in July 1982 as 84 aircraft priced at a hoped-for $3 billion unit price with spares $35.7 million. Deliveries are due in 1986-92 and Spanish industry was negotiating offset participation as this book went to press. The immediate task with Spain's EdA is to replace the Mirage IIEF in Esc 111 and 112, but with 84 aircraft it is planned to form four 18-aircraft squadrons. It will be cheaper to leave current equipment on the export Hornets and both foreign customers have signed for a number of two-seat F/A-18s which have about 10 per cent less internal combat capability, almost unchanged.

To sum up, the Hornet's prolonged birth has been traumatic, designers having yet achieved a true multi-mission combat aircraft. Digital flight controls and cockpit displays enable one man to fly a wide spectrum of missions, which will be expanded further as development is completed of a reconnaissance nose package which replaces the gun with extensive avionics. Its most remaining difficulties stem from the effects of inflation which have eroded its planned cost advantages over the F-14.

Below: Mk 83 bombs drop cleanly from the No 4 aircraft during level separation trials in 1979. On a combat mission some pylons would be occupied by tanks, sensors and ECM pods.

Northrop F-5

F-5A Freedom Fighter, F-5B, F-5E Tiger II, F-5F

Origin Northrop Corporation, USA with licence assembly in Turkey and many models licensed to Canada and Netherlands

Type: Light tactical fighter and attack/recon

Engines Two [illegible] afterburning turbojets, A-B [illegible] 3,080lb (1,850kg) thrust, 3,850 or 4,080lb (1,750 or 1,850kg) thrust; 21A

Dimensions Span A-B 25ft 3in (7.7m), A-B with tip tanks 23ft 7.8in (7.87m); F 26ft 8in (8.13m) [illegible] AAMs 27ft [illegible]; length A-B 47ft 2in (14.38m), B 48ft [illegible] (14.7m), F 48ft 7in (14.72m) [illegible]; A-B 17ft [illegible] (17.3m²),

Weights [illegible] A [illegible] 8,085lb (3,667kg) [illegible] 13,081lb (5,932kg) [illegible] 9,093lb (4,124kg), F 15,079lb (6,840kg) max [illegible] A 24,722lb (11,233kg), B 24,664lb (11,206kg), [illegible] 25,000lb (11,340kg), F 25,226lb (11,442kg)

Performance Max [illegible] 1,187kt, A 925kt (1,713km/h), Mach 1.63, B 925kt (1,713km/h), Mach 1.63, F 1,080kt (2,000km/h), Mach 1.89, [illegible] 1,077mph (1,734km/h), Mach 1.63, [illegible] 1,028kt (1,904km/h), Mach 1.63, [illegible] 50,000ft (15,240m), [illegible] 49,200ft (15,000m), A-B 28,700ft (8,750m), [illegible] 54,900ft (16,734m), [illegible] 3,875ft/min (19.68m/s), 1,025m/min, [illegible] 0kt (0km/h), [illegible] combat radius with max weapon load and allowance, A [illegible] 215 miles (346km), [illegible] 138 miles (222km), range with max fuel and tanks dropped with reserves, A 565 miles (2,518km), F 1,779 miles (2,863km)

Armament. A-B max military load 6,200lb (2,812kg) including two 20mm M-39 guns and wide variety of underwing stores plus AIM-9 AAMs for air combat, E-F wide range of ordnance to total of 7,000lb (3,175kg) not including two F-5F, one M-39A2 guns each with 280 rounds and two AIM-9 missiles on tip rails

History First flight N-156C 30 July 1959, production F-5A October 1963, (F-5E) 11 August 1972

Users: Canada, Greece, Netherlands, Norway, Spain, Turkey, USA (AF, Navy)

Deployment The Northrop N-156F lightweight fighter began as a private venture in 1956 and eventually the first USAF T-38 Talon trainer prototype flew on 10 April 1959, to be followed by the N-156C tactical fighter. At that time the Air Force bought the fighter but eventually with Department of Defense backing Northrop sold more than 1,040 to the F-5A and -B and the F-5E and -F versions, plus another 116 F-5s built by Canadair (CF-5A and -D) for the Canadian air force and 70 built by ASTA in Spain. A new trainer version, the F-5B, was developed, the same models as the F-5A, and the two-seater then went into production. Norway and Denmark ordered AIDC-built [illegible] presently leases the Canadian F-5s with more powerful J85-engined [illegible] 4,080lb (1,850kg) thrust. Netherlands Northrop has many [illegible] F-5s and F-5Es from the USA. Large orders have been received by Singapore and Malaysia, mainly for the new [illegible] with improved combat capability provided by two M-39 20mm guns and two Sidewinder. Greece has the [illegible] Netherlands [illegible] ▶

Above: This F-5E is one of ten passed to the US Navy and assigned to the Navy Fighter Weapons School at NAS Miramar, California, for use in 'Aggressor' type dissimilar air-combat training.

Above: Takeoff, probably from Nellis, of one of the Aggressor F-5Es used by the US Air Force. Together with similar aircraft of the Navy they have been used to evaluate at least 14 colour schemes to reduce air-combat visibility or to confuse the enemy as to attitude.

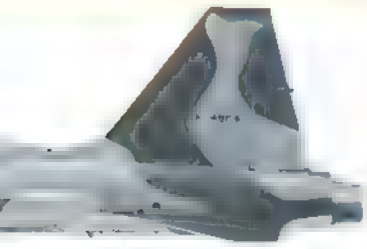
Left One of the earlier F-5A generation, serving with the Greek 341 Mira, 111 Pterix, based at Achialos in 1971.

▶ rons to be replaced by F-16s in 1985-89. Norway, two squadrons being replaced by F-16s now. Spain, two squadrons including SRF-5A recce aircraft) and Turkey, five squadrons plus one of RFs.

Canada's CF-5s are being withdrawn and some have been sold to Venezuela. The F-5F and two-seat Fuerza Aérea Tiger II aircraft have already replacements, notably including a single Emerson APQ-153 radar and more powerful J85 engines, and though they still do not pretend to be all-weather or sophisticated tactical aircraft, they are very attractive bargains at low price. By late 1982 the Tiger had sold to 19 air forces a total of almost 1,400 military aircraft. The only NATO customers are the USA itself, not a surprising choice for the F-5A-B, which was designed and built as an economical mount for advanced fighter pilot training. The USAF received its first by August 1973, and by mid-1982 had a total of 170 in service, including 46 with the 57th FWW at Nellis and 26 with the 527th TFTS at RAF Alconbury. The Navy has 10 F-5Es and three F-5Fs for Top Gun training at NAS Miramar.

Right Four of the Aggressors in experimental or simulated Warsaw Pact camouflage, with 'enemy' aircraft nose numbers.

Below Low-visibility camouflage by a 'Top Gun' F-5E from NAS Miramar is spoilt by red turbine warning bands



Left. The Netherlands KLu (air force) still uses NF-5A and (as here) two-seat NF-5B Freedom Fighters built in a partnership between Dutch industry and Canadair. This NF-5B was assigned to Nr 313 Squadron at Twenthe and is shown with 'Coke-bottle' wingtip tanks of early F-5s supplemented by a drop tank.

Panavia Tornado ADV

Tornado F.2

Origin: Panavia Aircraft GmbH with especial responsibility (and assembly and flight test) by British Aerospace

Type: Two seat long-range interceptor

Engines Two Turbo-Union RB.199 Mk.103 each rated at 16,000lb (7,258kg) thrust with maximum afterburner

Dimensions: Span (25°) 45ft 7¼in (13.9m) (65°) 28ft 2½in (8.6m) length 59ft 3in (18.06m), height 18ft 8½in (5.7m), wing area not published

Weights Empty equipped about 31,500lb (14,290kg) takeoff weight (clean, maximum internal fuel) 47,500lb (21,546kg) maximum not published

Performance Maximum speed (clean) at high altitude about 1,500mph (2,414km/h Mach 2.27) combat radius with max AAM load 212nm on station at distance of 175 miles (607km) from base with Mach 0.9 combat

Armament One 27mm Mauser cannon, four Sky Flash (later AMRAAM) recessed under fuselage and two AIM-9L Sidewinder AAM (later ASRAAM)

History First flight 27 October 1979, service delivery late 1983, operational squadron late 1984

User: UK (RAF)

Deployment Development of Tornado ADV Air Defence variant was authorised by the British Government in March 1976 to provide a replacement for the Lightning and subsequently the Phantom in the RAF air defence role. None of Britain's NATO partners has to defend so large a volume of airspace, extending from Iceland to the Dutch coast and from the Atlantic approaches to the Baltic. The task demands an aircraft possessed not only of very high performance but also very long range at lowest fuel cost, the most modern long-range radar and missiles with snap-down capability against intruders at very low altitude, and the ability to operate autonomously at great distances from any friendly base in the worst ▶

Above. Despite its optically flat windscreen and large two-man canopy the Tornado F.2 is the world's fastest aircraft at low level, and one of the fastest at higher altitudes.

Below: First ADV prototype flew in October 1979 This version is tailored to RAF requirements, but there would be no problem in producing a multi-role interceptor/attack variant.

▶ possible weather at night against multiple targets at all altitudes in the most severe ECM conditions. The task is wholly beyond the capacity of the Lightning and even the Phantom cannot meet any of these demands fully. In contrast the Tornado provided a basis for what is certainly the best and most cost effective long range interceptor in the Western world. Much of the basic aircraft, especially including the German centre fuselage and main wings, remains almost unchanged from the three nation IDS version. The forward fuselage made by BAe is new. To accommodate the four medium range missiles initially Sky Flash, recessed under the belly the overall length is increased by 53 in (1.36m) which in turn increases internal fuel by 200gal (909 litres). The inflight refuelling probe is a permanent retractable installation in the roof of the cockpit instead of detachable unit on the right. The main radar is the completely new Marconi Ferranti Foxhunter pulse doppler set with track while scan capability in a longer and more pointed radome which improves supersonic acceleration. Extremely comprehensive communications and EF equipment is carried plus a low light TV for greatly magnified visual images (ranges in the 100 mile (161km) region. The fixed wing stubs are larger, more swept and devoid of Kruger flaps. Eight Inter Service Celstar/Ptarmigan systems and from 1984 Tornado F.2s will replace Lightnings in 5 and 11 Sqns followed by the Phantoms of 23, 29, 43, 56 and 111 Sqns. A total of 165 is required in addition to the three prototypes and 70 were on order in 1982, 18 in the fourth Tornado production batch of 162 aircraft and 52 in the fifth batch of 171, a further increment was due in early 1983 bringing the total by that year close to the RAF requirement. It is considered highly likely that other NATO countries will also purchase this aircraft.

Right: Fuselage of the interceptor was lengthened in order to accommodate tandem pairs of Sky Flash missiles. This enabled an additional 200gal (909 litres) of fuel to be accommodated and, with reduced nose angle, has improved speed and acceleration.

Below right: The first prototype in a tight turn with wings at their maximum 68° angle. With two tanks, as here, a CAP endurance of 4h 13min without refuelling has been demonstrated.

Below: An unusual attitude by a later Tornado F.2: steep climb with gear down and engines in cold thrust. Note the full-span double-slotted flaps and (just visible) leading-edge slats.

Panavia Tornado IDS

Tornado IDS (GR.1) and dual (T.3)

Origin. Panavia Aircraft GmbH, international company formed by British Aerospace, MBB of W. Germany and Aeritalia

Type. Two-seat multi-role combat aircraft optimised for strike. Tri-dual trainer

Engines. Two Turbo-Union RB.199 Mk.101 or 103 augmented turbofans each rated at 15,800lb (7,167kg) with full afterburner

Dimensions. Span 28ft 2½in (13.90m) (68ft 10½in (20.80m) swept); length 54ft 9in (16.72m); height 18ft 8in (5.7m); wing area not published

Weights. Empty equipped about 30,865lb (14,000kg); loaded clean about 45,000lb (20,411kg); maximum take-off about 60,000lb (18,150kg)

Performance. Maximum speed clean at sea level over 820mph (1,480km/h), Mach 1.2; at high level over 1,452mph (2,337km/h), Mach 2.2; service ceiling over 50,000ft (15,240m); combat radius 8,000lb (3,632kg) bombs (hi-lo-hi) 863 miles (1,390km)

Armament. Two 27mm Mauser cannon in lower forward fuselage; seven pylons, three (centre, fuselage and four on the swing wings for external load up to 18,000lb (8,165kg)

History. First flight prototype 14 August 1974; production IDS July 1979; service delivery IDS to training unit February 1978; squadron service, RAF Luft. MFG) 1982

Users. W. Germany (Luftwaffe, Marineflieger); Italy; UK (RAF) ▶

Above. A 1975 picture of the third prototype carrying ECM pods, tanks and eight dummy bombs of low-drag 1,000lb (Mk 83) type.

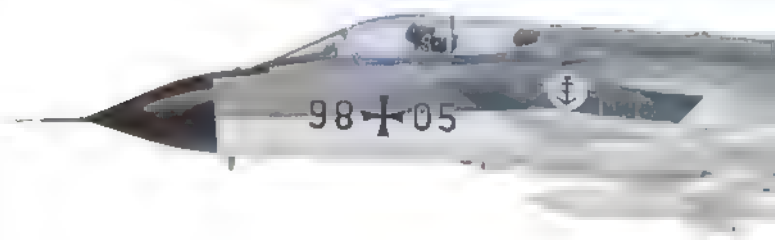
Above Another view of the same aircraft in the same loaded configuration as seen at left The production ECM pod for the RAF Tornado force is at present the MSDS ARI 23246/1, sometimes known as Sky Shadow (and originally as Ajax).

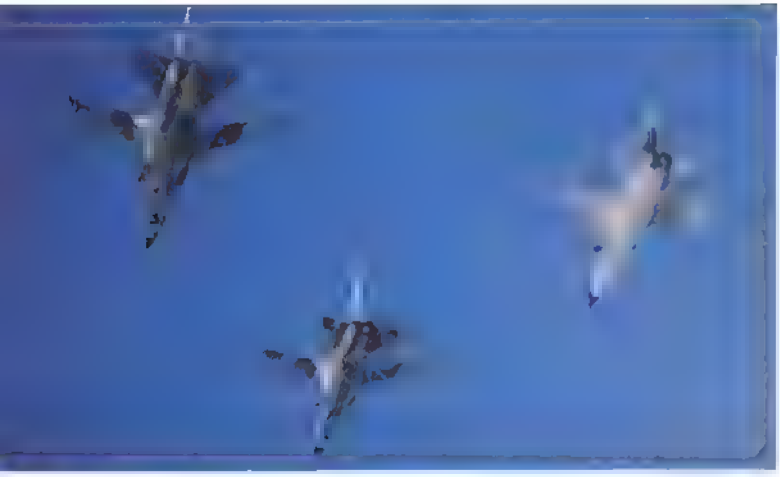
Below: Tail number G-24 means 24th Luftwaffe single-seater, and TTTE tail badge means the Trinational Tornado Training Establishment.

Above It is possible to take off in cold thrust, and this MFG aircraft is doing just that; location is TTTE at Cottesmore.

▶ **Deployment** With the F-16 the Tornado is the most important aircraft in the NATO alliance in Europe. Unlike all other aircraft it was designed specifically to meet the requirements of four major customers in three nations, and it is remarkable that three nations working in partnership should have succeeded in creating an aircraft at once so outstanding in capability and versatility and so uniform in its first four customer variants. The RAF interceptor variant is described separately. Its basic missions are similar to those of the F-111, but the Tornado differs in being more compact fighter and much more fuel efficient and in having avionics ten years later in conception. The most experienced attack crews are unanimous in claiming that it is the first aircraft in history which can be flown on long missions at night or in bad weather at treetop height without severe strain, tiredness or any degradation in human performance.

Features include an advanced multimode forward-looking radar with the option of various types of programmable software, a TFR terrain-following radar, electrically signalled FBW (fly-by-wire) flight controls with artificial stability, fully variable supersonic inlets, which help make this the fastest aircraft in the world at low level and one of the fastest at all heights, despite the extremely compact, light-weight configuration, advanced avionic systems to manage the array of stores which can be carried, which exceeds that of any other aircraft, and modern tandem cockpits with head-up and head-down displays in the front, and three electronic displays in the back. Among the stores which had been cleared by 1983 are all tactical bombs of the four initial customers, rocket pods, Sidewinder AAMs and Sea Eagle, Kormoran, Maverick, Hobos, Paveway, AS.30 and AS.30L. Many more are to be cleared. Asraam, BL.755, P.2.3 and MW-1 dispenser and possibly ▶





Above: Three aircraft—two RAF and one Luftwaffe—on a training sortie from the TTTE at Cottesmore seen in early 1981

Above Eight Tornados being assembled at Aeritalia's Turin, Caselle, plant, out of 100 on order for AMI.

Left: This Tornado was built as the 04 prototype, flown in 1975 as D-9592, and later repainted as shown in MFG markings for testing at the Erpröbungsstelle 61 at Manching, Germany Note four Kormoran missiles.

▶ MRASM will also be cleared later. Aircraft versions have comprehensive internal radar warning systems, and while German and Italian Tornados carry the ECM 73 deception jammer developed by Elettronica, AEG Telefunken and MSDS, the RAF aircraft use the AR 732/16 Sky Shadow by MSDS with parts by BAe, Plessey and Racal Decca.

Deliveries began to the TTTE Tornado Tri-national Training Establishment at RAF Cottesmore in 1980, which had its complement of 50 aircraft in 1982. By this latter year the RAF weapons training unit at Honington was in full operation as was the Luftwaffe equivalent at Pronning and RAF No 9 (TX) Squadron converted from Vulcans at Marineflieger MFG 1 had largely completed conversion from the F.104G. Deliveries by late 1982 were close to 150, despite a slow power-up post-production rate of the series. The first pre-series aircraft were all prototypes, but the first production increment of the Standard 1 (Interdictor) version for the four original customers was 644: 220 Tornado GR.1 for the RAF, 212 for the Luftwaffe, 112 for the Marineflieger and 100 for the Italian AM. By late 1982 contracts had been signed for five production batches: 10, 20 GR.1 for the RAF, 17 for the Luftwaffe, Marineflieger and three prototype ADVs; 110, 65 RAF, 40 Luftwaffe, Marineflieger and 15 AM; 164, 68 RAF, 68 Luftwaffe, Marineflieger and 28 AM; 162, 53 RAF, plus 8 more for Falklands reinforcement and 171 (52 F.2), making a total at that time of 647.

The RAF GR.1s are the Vulcan's long-range interdictor replacement, normally operating from Akrotiri, Cyprus, with No IX based at Honington. The Tornado may have been a Waddington aircraft, but not been announced how many GR.1 squadrons will be based there. It is presumably an 1 Group, not whether a dedicated tactical reconnaissance Tornado variant will replace the Vulcan SR.2s of 27 Sqn in the maritime reconnaissance role in RAF Germany. 2 ATAF the GR.1s is progressively replacing the Jaguar in the three-squadron strike wing at Bruggen and four squadrons will replace the two Buccaneer units at Laarbruch and the Jaguar recon squadron. This in effect adds one squadron, eight replacing seven, and implies a multi-sensor Tornado probably a standard aircraft carrying the advanced IR system being developed by BAe Dynamics plus optical cameras.

Above One of the German-assembled prototypes (believed to be No 07, which introduced an almost complete internal avionic kit) parked at Manching with fuselage bombs, tanks, ECM, data-link and instrumentation pods. Cover plates are fitted in the inlets

Below The 13th Tornado, first with production kinked taileron, was used for flight testing the bulky, high-drag MW-1 dispenser which comprises four sections each with 28 double-ended tubes from which bomblets or delay-action mines are projected.

Rockwell International B-1

B-1B

Origin. Rockwell International North American Aerospace Operations USA

Type: Strategic bomber and missile platform

Engines: Four General Electric F101 GE 102 augmented turbofans each rated at 29 900 lb (13,563kg) with full afterburner

Dimensions Span fully spread 136ft 8¾in (41.67m) fully swept to 67 5½) 78ft 2¾in (23.84m) length (including probe) 150ft 2¾in (45.78m) wing area (spread) gross 1 950sq ft (181.2m²)

Weights Empty about 160 000lb (72 576kg) maximum loaded 477 000 lb (216 367kg)

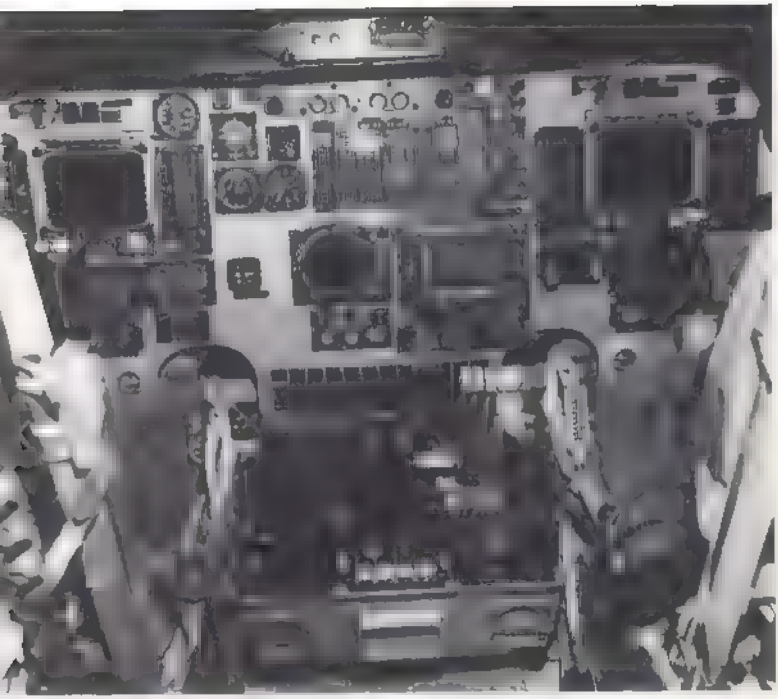
Performance Maximum speed (over 36 000ft/11km) about 1 000mph (1 600km/h) Mach 1.5+ (500ft/152m) 750mph (1 205km/h) Mach 0.99 typical high altitude cruising speed 620mph (1 000km/h), range with maximum internal fuel over 7 000 miles (11 265km) field length less than 4,500ft (1,372m)

Armament: Eight ALCM internal in weapon bays separated by movable bulkhead plus 14 external 24 SRAM internal plus 14 external 12 B28 or B43 internal plus 8 14 external 24 B61 or B83 internal plus 14 external 84 Mk 82 internal plus 44 external 80 000 lb 36 288kg

History Original AMSA study 1962 contracts for engine and airframe 5 June 1970 first flight 23 December 1974, decision against production June 1977 termination of flight test programme 30 April 1981 announcement of intention to produce for inventory September 1981 first flight March 1985 first delivery late 1985 planned OC July 1987

User: USA (Air Force) ▶

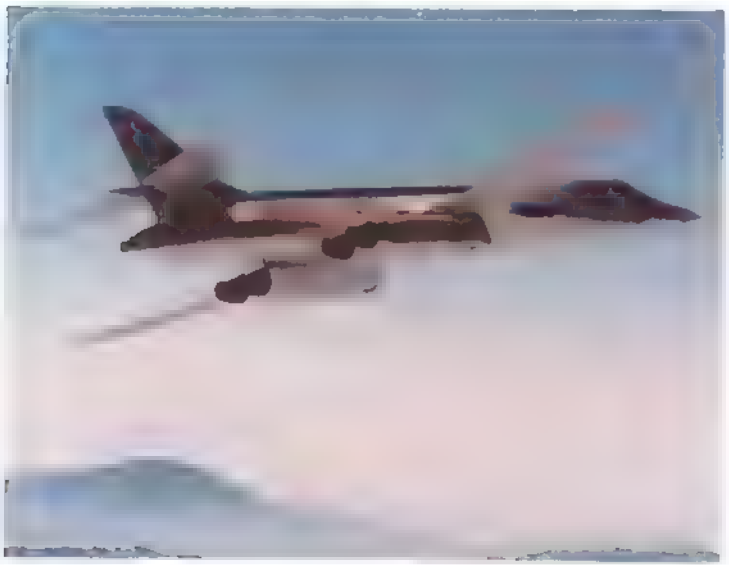
Below: The No 4 prototype has the dorsal spine, blunt tail and many other external features which will be repeated on the B-1B.



Above: Like the basic aircraft the cockpit has developed greatly since the 'Hi-Fi' mockup of 1971; B-1B will have small changes.

▶ **Deployment:** No aircraft in history has had so long a gestation as the B-1 strategic bomber, planned since 1962 under different names and configurations as a replacement for the B-52. Eventually four B-1A prototypes were tested, but in June 1977 President Carter cancelled the programme. It was resurrected in September 1981 when President Reagan announced that 100 of an improved model, the B-1B, would at last be built for Strategic Air Command. Development is being helped by resuming flight testing of B-1A Nos 2 and 4, and externally these, especially No 4, look very like a B-1B. Features of the latter will include total concentration on low-level subsonic operations with fixed engine inlets and conventional ejection seats instead of a crew capsule, and flexibility to carry conventional bombs and various ASMs as well as nuclear free-fall bombs. The B-1B dispenses with further high-altitude cost features, the wing sweep being reduced to about 59.5°. As well as retaining the B-1B can carry much more fuel, a delayed weight reduction programme reduces empty weight while gross weight is raised by over 37 tonnes. Main gears are stronger, wing gloves and engine inlets totally redesigned, many parts of the control fins, flaps and bomb doors, for example, made of composite material, pneumatic starters with cross-bleed fitted, offensive avionics completely updated (main radar is Westinghouse's APG-66), the ALQ-161 defensive avionics subsystem fitted, RAM radar-absorbent material fitted at some 85 locations throughout the airframe, and the whole aircraft nuclear-hardened and given Multiplex wiring.

Radar cross-section will be less than one-hundredth that of a B-52 (and only one-tenth that of a B-1A) at 10sq ft (0.93m²), and the avionic systems will be dramatically more capable even than those of the B-1A which were revolutionary for their period. A classified study showed that even the B-1A would have remarkable capability to penetrate large and heavily defended regions of airspace, and the B-1B is expected to be a viable weapon until at least 2000. The US Defense Secretary caused a stormy reaction from everyone associated with the B-1B when he said it would penetrate Soviet airspace only until 1989 or 1990, as evidence shows this to be a surprising misconception, possibly in order to increase political acceptance of the proposed next-generation stealth bomber. B-1B programme cost has been estimated at $20.5 to $39 billion in 1981 dollars, and the main argument now is whether it might not be better to wait for the stealth aircraft. To do so would be an extremely foolish choice.



Above· Tail-on aspect of fourth aircraft, showing blunt tail with vortex generators Subcontractor for the two rear-fuselage sections is Vought, much of the skin being titanium alloy.

Below left. Radar cross-section of the four B-1A prototypes has averaged about one-tenth that of a B-52 from frontal aspects Production B-1B is expected to be roughly ten times better still.

Below The long-span flaps are visible on the unswept wings in this takeoff picture. There are no ailerons, and the production bomber will have simplified lower-drag overwing root fairings.

Rockwell International OV-10 Bronco

OV-10A to -10E

Origin: Rockwell International, USA
Type: (Except B) two-seat multi-role counter-insurgency; (B) target tug
Engines: Except B/Z) two 715shp Garrett T76-G-410/411 turboprops; B/Z) as other versions plus General Electric J85-4 turbojet of 2,950lb (1,338kg) thrust above fuselage
Dimensions: Span 40ft 12.19m; length except D) 41ft 7in (12.67m); D) 44ft 13.4m; height 15ft 2in (4.62m); wing area 291sq ft (27.03sq m)
Weights: Empty (A) 6,969lb (3,161kg); maximum loaded (A) 14,466lb (6,563kg)
Performance: Maximum speed: A) sea level, clean 281mph (452km/h); initial climb 2,300ft (700m)/min; (B/Z) 6,800ft (2,070m)/min; service ceiling 30,000ft (9,150m); range with maximum weapon load about 600 miles (960km); ferry range at 12,000lb gross 1,428 miles (2,300km)
Armament: Four 7.62mm M60C machine guns in sponsons; 1,200lb (544kg) hardpoint on centreline and four 600lb (272kg) points under sponsons; one Sidewinder missile rail under each wing; OV-10D as other versions plus three barrel 20mm cannon in remotely aimed ventral power turret
History: First flight 16 July 1965; production OV-10A) 6 August 1967; (YOV-10D) 9 June 1970
Users: W Germany, USA (Air Force, Marine Corps)

Deployment Some outcome of the prolonged studies of Colin (counter insurgency) aircraft in the USA in the early 1960s, the OV-10 is a unique aircraft which combines STOL, rough-field capability, flight agility, protection against small arms fire at low levels, a wide spread of tactical weapons and a nacelle seating pilot and observer in tandem (with an almost perfect view) with a cabin behind for cargo, including five paratroops or two stretcher (litter) casualties. These eager machines hum and buzz in

Above: This Marine Corps YOV-10D prototype has now led to squadron deployment of 17 basically similar OV-10D Night Observation Surveillance aircraft with much new equipment.

many parts of the world including Federal Germany where the Luftwaffe uses six Ov-10Bs and 12 Ov-10B/Zs for target towing duties. The USAF received 157 Ov-10As used in the FAC (forward air control) role and these now serve in the utility role as well as practising the light armed recon and attack mission. One of several units using the type is the 4th ATAF the 601st TCW at Sembach AB Germany. The US Marine Corps has 24 OV-10Ds with greatly augmented avionics deployed in three squadrons in the NOS (night observation surveillance) role.

Below: Rocket practice with an OV-10A of the US Air Force.

Saab 35 Draken

J35D and F, Sk35C, S35E and export versions

Origin: Saab-Scania AB, Sweden

Type: J35 F 35, single seat all weather fighter bomber (Sk35 TF 35) dual trainer (S35 single seat all weather reconnaissance

Engine One Svenska Flygmotor RM6 licence built Rolls Royce Avon with SFA afterburner (D E F and export 17 110lb (7 761kg RM6C

Dimensions: Span 30ft 10in (9 4m), length 50ft 4in (15 4m (S35E 52ft 15 8m height 12ft 9in (3 9m), wing area 529 6sq ft 49 2m²

Weights Empty (D) 16 017lb (F) 18 180lb (8 250kg) max mum loaded (D) 22 663lb 10 280kg, (F) 27 050lb (12 270kg) (F 35) 35 275lb (16 000kg)

Performance Maximum speed (D onwards clean) 1 320mph (2 125km/h Mach 2 0), (with two drop tanks and two 1 000lb bombs) 924mph 1 487km/h Mach 1 4 initial climb (D onwards clean 34 450ft (10 500m) min service ceiling (D onwards clean about 65 000ft (20 000m range internal fuel plus external weapons typical 800 miles (1 300km) maximum fuel 2 020 miles (3 250km)

Armament (F one 30mm Aden plus two RB27 Falcon (radar) and two RB28 Falcon (infra red) missiles plus two or four RB24 F 35) two 30mm Aden plus nine stores pylons each rated at 1 000lb (454kg) all usable simultaneously, plus four RB24

History: First flight 25 October 1955, production (35A) 15 February 1958, final delivery (35XS) 1975 (Danish TF-35) 1976
User: Denmark

Deployment This high-supersonic aircraft was by far the most advanced warplane on the drawing boards of Western Europe in the early 1950s and when the first production version entered service in Sweden in 1959 it essentially did the same job as the Lightning with just one afterburning Avon instead of two, and with greater range. In NATO the Drakens is flown by the Danish KDF, which has rapidly replaced its F-100s and F-104s by the F-16 but will keep the popular Drakens at least until 1987. They equip the Karup wing, comprising 725 (sk) squadron tasked in the ground attack role and 729 in the reconnaissance role, in each case with 17 or 18 single-seaters backed up by two-seat TF-35s. The F-35s of No 725 are being completely overhauled and refurbished with a structural audit to give an extended life in high-speed missions at low level with heavy bomb racks and new avionics, including an advanced HUD, head-up display, and weapon-delivery systems. The Drakens combine short-field length, excellent manoeuvrability at all heights, good serviceability at low cost and the ability to give a good account of themselves in the secondary air-combat role with guns and Sidewinders.

Below: One of the last Draken variants was the Danish TF-35, a multirole combat-capable tandem-seater usually used for training

SEPECAT Jaguar

Jaguar GR.1 and T.2, Jaguar A and E

Origin: SEPECAT consortium formed by British Aerospace (BAC) and Dassault-Breguet, France

Type (GR.1 and A) single seat all weather attack (T.2 and E) dual operational trainer

Engines Two Rolls-Royce/Turbomeca Adour augmented turbofans, A, E 7,305lb (3,313kg) Adour 102, GR.1, T.2 8,040lb (3,647kg) Adour 104

Dimensions Span 28ft 6in (8.69m), length except T.2, E 50ft 11in (15.52m), (T.2, E 53ft 1in (16.42m), height 16ft 0in (4.89m), wing area 260.27sq ft (24.18m²)

Weights Empty about 15,432lb (7,000kg), normal take-off, internal fuel and gun ammunition 24,149lb (10,954kg), max. take-off weight 34,612lb (15,700kg)

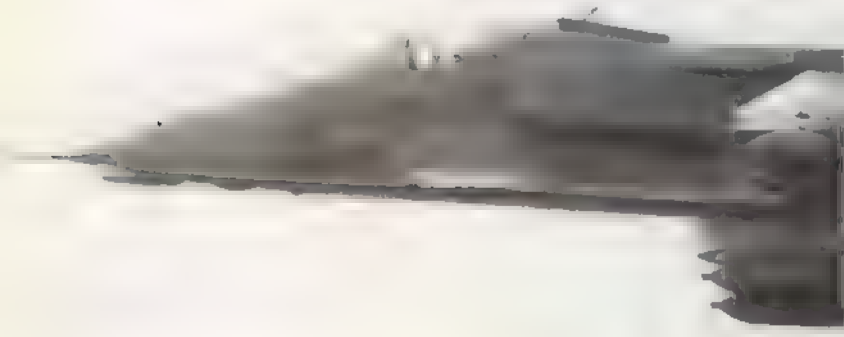
Performance: Maximum speed (clean, some external stores) 1,056mph (1,700km/h, Mach 1.6), (some external stores) 1,056mph (1,700km/h, Mach 1.6), attack radius (lo-lo-lo with external fuel and two 30mm guns) 530 miles (852km), ferry range 2,614 miles (4,210km)

Armament. A, E two 30mm DEFA 553 each with 150 rounds, five pylons for total external load of 10,500lb (4,763kg), GR.1 as above but guns two 30mm Aden, (T.2) as above but single Aden

History First flight E, 8 September 1968 (production E) 2 November 1971, production GR.1 11 October 1972, squadron delivery E, A May 1972, (GR, T) June 1973

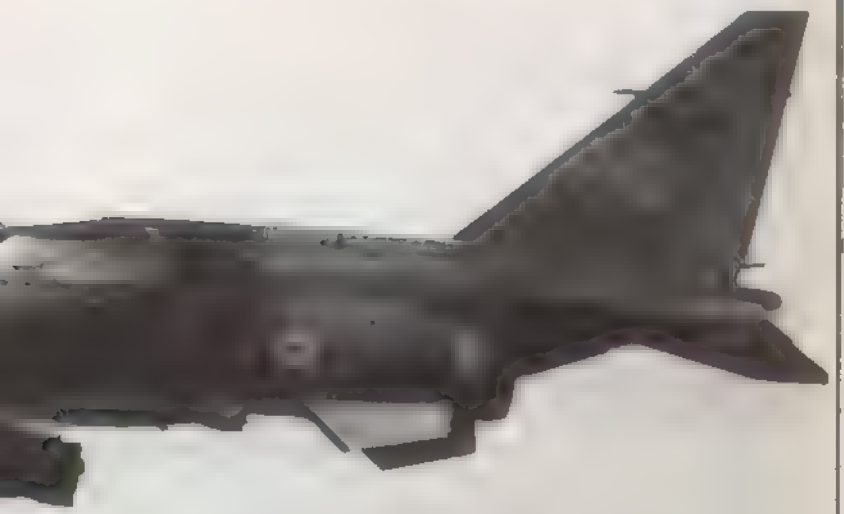
Users: France, UK (RAF)

Deployment Developed jointly by BAC (now BAe) in Britain and Dassault-Breguet in France to meet a joint requirement of the Armee de l'Air and RAF, the Jaguar matured as an extremely capable and useful tactical attack aircraft with a combat capable two seat version used mainly as an advanced and weapons trainer, the extra seat displacing the nose avionics and leaving fuel capacity unchanged. Powered by two very small afterburning turbofans, the Jaguar stands high off the ground on undercarriage with lowered suspension and twin wheels, making the aircraft eminently ▶



Above: Jaguar A of l'Armée de l'air which is clean except for the 264gal (1200 litre) drop tank. France wants updated Jaguars throughout the 1980s

Below: Armée de l'Air EC4/11 'Jura' has late A-type Jaguars (this is A121) with Atlis II laser guidance, though this cannot guide these 'iron bombs'.



▶ suitable for off base dispersal even with very heavy external weapons loads – a capability too shyly seldom practised – so that ever these aircraft could at any time be caught on the airfields. RAF Germany's complete wing at Bruggen tasked in the army support and strike role. 17, 20 and 31 Sqns and at Laarbruch is a combined strike and reconnaissance unit using a multi-sensor external pod (2 written). Sqns. The RAF aircraft have comprehensive inertial nav attack systems with a chin-set nose laser and adequate equipment for one-man weapon delivery in adverse conditions. Normal weapons carried are 1,000lb (454kg) or nuclear bombs, rocket and BL 755 cluster dispensers. This wing is progressively being equipped with the Tornado GR1. A further three squadrons, 6, 41 and 54, are based at RAF Coltishall, Norfolk, tasked with army support and with No 41 also having reconnaissance pods. All RAF Jaguars have uprated Mk 104 engines. ECM includes the usual tail-mounted ARI 8223 passive warning, but perhaps shortsightedly it has been decided to abandon long-discussed plans to fit internal active countermeasures, just as it has been decided to drop the decision to fit new, larger, high-lift supercritical wings.

France received the last of its 200 Jaguars in December 1981. These retain the original Mk 102 engine and have a new gyro platform and computer instead of an inertial system, no laser and seats which cannot be used at below 164mph (167km/h). Armée de l'Air and Armée de Terre aircraft equip three squadrons of EC 3 at Nancy-Ochey, two of EC 7 at St Dizier with a fourth in the nuclear role at Istres, three of EC 11 at Toul-Rosières and EC 4/11 at Bordeaux-Mérignac. The newest 30 Jaguar As have an Atlis laser TV pod used in conjunction with the AS 30L smart missile. The Armée de l'Air has several update proposals for its Jaguars, which are expected to remain in use until at least 1989.

Above: A rare echelon of GR.1 single-seaters from all five RAF Germany squadrons; No 2 (foreground) carries the recon pod.

Below: Vapour streams from the wingtips of two Jaguar GR 1s of RAF No 20 Sqn, from Brüggen, as they pull round a *schloss* waypoint.

Vought A-7 Corsair II

A-7A to A-7P

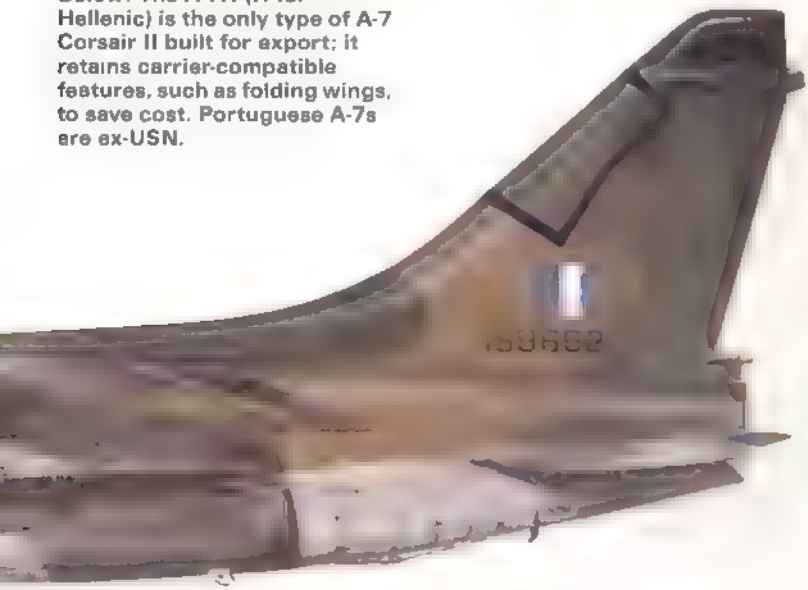
Origin. Vought Corporation, USA
Type: (except K) attack (K) combat trainer
Engine (A) one 4 250lb 6 486kg thrust Allison TF41 1 turbofan (E) one 15 000lb 6 804kg TF41 2 (P) one 12 200lb 5 534kg Pratt & Whitney TF30 408 turbofan
Dimensions Span 38ft 9in (11 8m) (except D) 46ft 1in 14 06m) (K) 48ft 11½in (14 92m), wing area 375sq ft (34 83m)
Weights Empty (A) 19 781lb 8 972kg loaded (A) 42 000lb 19 050kg
Performance Maximum speed (A) sea level 691mph 1 110km/h (5 000ft 1 112km/h) with 2 Mk 82 bombs 645mph 1 040km/h clean radius with unspecified weapons load at unspecified height 715 miles 1 151km) ferry range internal fuel 2 281 miles 3 671 km) (max with external tanks) 2,861 miles (4 604km)
Armament One 20mm M61A1 gun with 1 000 rounds and up to 15 000lb 6 804kg of tactical weapons on eight hardpoints (two on fuselage each rated 5 000lb 227kg two more on wing pylons each 2 500lb 1 134kg and outboard wing pylons each 3 tons 1 587kg)
History First flight Navy A-7A 27 September 1965 (D) 26 September 1968 (K) January 1981
Users: Greece, Portugal, USA (Navy ANG)

Deployment The Corsair was originally derived from the supersonic F-8 Crusader fighter to meet a Navy need for a subsonic carrier attack aircraft with a much heavier bomb load and greater fuel capacity than the A-4. So effective did the A-7 prove that in 1966 it was selected to equip a substantial proportion of USAF TAC wings and ultimately 457 A-7Ds were acquired. These introduced a more powerful engine derived from the Rolls-Royce Spey with gas turbine self-starting and multi-barrel gun and a totally revised avionic system for continuous solution of navigation problems and precision placement of free-fall weapons in all weather. The folding wings and arrester hook were retained and other features included a strike camera boom receptacle instead of a probe, boron carbide armour over cockpit and engine and McDonnell Douglas Escapac seat. Avionics have been further improved over the years, but the main features of a Corsair's have always been a robust airframe and systems good range and endurance the ability to carry heavy and varied loads and air-ground delivery of stacy which set a new standard that has only recently been surpassed by the F-16 and F/A-18. At the active force of 350 A-7Ds have been passed to the ANG which in mid-1985 was starting to replace obsolete F-4s on 48 aircraft bases with high returning to the A-7 at the expense of the Navy the current version is the A-7E which was passed on to the ANG. The still highly effective A-7D is very much a front-line aircraft with 24 attack squadrons ashore or embarked plus two shore-based training squadrons. Of these 13 are ▶

Above Seen here before delivery from the Vought plant at Dallas, this A-7H serves with the Elliniki Aeroporia (Greek AF), which has three squadrons, Nos 340, 345 and 347. They were bought new.

Above Final production Corsair was the A-7K, a combat-capable two-seater for the US Air National Guard. This particular K went to the 162nd Tactical Fighter Training Group, Arizona ANG

Below: The A-7H (H for Hellenic) is the only type of A-7 Corsair II built for export; it retains carrier-compatible features, such as folding wings, to save cost. Portuguese A-7s are ex-USN.



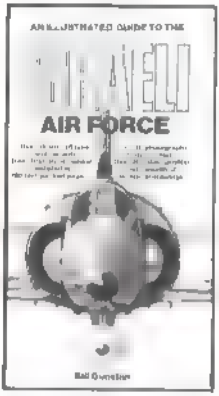
assigned to the Atlantic Fleet. A further six Navy Reserve squadrons fly the earlier TF30 powered A-7B. Newest of all the US variants is the two seat A-7K, 42 of which should by late 1983 have been distributed in pairs to 11 of the 13 ANG combat ready A-7D units plus a further 16 to the 162nd Tac Fighter Training Group at Tucson. A direct view tube provides for Walleye and similar TV ASM guidance, and Pave Penny pods are carried for laser guided stores. Bomb accuracies are in the range 2-3m (say 8ft) with free fall bombs.

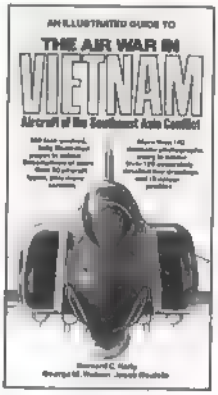
Among European customers, Greece purchased 60 A-7H new from Vought, and these are virtually A-7Es with the more powerful model of TF41 and the pilots trained with the US Navy and not the USAF. The Hellenic equips three miral squadrons all in the maritime support and anti-ship role. 340

and 345 at Souda Bay, Crete, and 347 at Larissa in the north. The Greek Aeroporia also bought six two-seat TA-7H similar to the A-7K. Portugal was eager to obtain more effective combat aircraft but had little money and voluntarily selected 20 A-7As were used by the US Navy and before delivery completely refurbished by Vought. The engine remains the TF30 but improved to P-408 standard and the airframes have been brought up virtually to A-7E standard. These are all in Esc 302 at Monte Real replacing the F-86 but tasked primarily in the strike role the FAP still needs an air-combat fighter.

Below 500lb (227kg) Snakeye retarded bombs occupy the wing pylons of this A-7D of the 23rd TFW, England AFB, Louisiana.

OTHER SUPER-VALUE MILITARY GUIDES IN THIS SERIES.....





OTHER ILLUSTRATED MILITARY GUIDES NOW AVAILABLE.

Allied Fighters of World War II
Bombers of World War II
German, Italian and Japanese Fighters of World War II
Modern Fighters and Attack Aircraft
Modern Soviet Navy
Modern Submarines
Modern Tanks
Modern US Navy
Modern Warships
Pistols and Revolvers
Rifles and Sub-Machine Guns
World War II Tanks

* Each has 160 fact-filled pages
* Each is colourfully illustrated with hundreds of action photographs and technical drawings
* Each contains concisely presented data and accurate descriptions of major international weapons
* Each represents tremendous value

If you would like further information of any of our titles please write to:

Publicity Dept (Military Div.) Salamander Books Ltd.,
27 Old Gloucester Street, London WC1N 3AF


001

A magnificently illustrated, compact directory of the front-line combat aircraft serving NATO's air forces

☆☆☆

More than 40,000 words of text and data
Over 170 full colour illustrations